DISCOVERING A BIOPHILIC SEOUL

A THESIS

SUBMITTED TO THE GRADUATE SCHOOL

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS

FOR THE DEGREES

MASTER OF URBAN AND REGIONAL PLANNING

MASTER OF SCIENCE DISCOVERING A BIOPHILIC SEOUL

BY

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BALL STATE UNIVERSITY

MUNCIE, INDIANA

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BALL STATE UNIVERSITY

MUNCIE, INDIANA

MAY 2017

ABSTRACT

THESIS: Discovering a Biophilic Seoul

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Despite being inhabited for more than 2000 years; the city of Seoul grew in isolation from Western cultures until the 19th century. However, because of being almost destroyed during the Korean War, the city spent most of the second half of the 20th century trying to rebuild itself. After recovering, Seoul shifted its policies to become a sustainable development-oriented city. Thus, the city engaged in its first major nature recovery project, the Mt. Namsan Restoration project, in 1991 and it enacted the first 5-year Plan for Park & Green Spaces in 1996, which pinpointed the start of the Green Seoul era. Biophilic cities are (ideal) cities that have copious amounts of nature, as a part of their design (Beatley, 2010). Prior research has revealed that Biophilic urbanism helps reducing urban heat island effect, and greenhouse emissions while bringing the emotional and psychological benefits of nature into the urban environment. However, the existing biophilic literature is largely focused on North American and European cities and, therefore, biophilic elements of non-western cities have yet to be comprehensively studied. This study aims to complement the current biophilic urbanism movement, by recording and analyzing the biophilic elements occurring in the Asian city of Seoul, Korea. To do so, I surveyed how much Seoulites consider the nature in their everyday life, I created an inventory of the major constructed nature projects that the city has started or completed since 1996 was done, and I study of the spatial distribution of green spaces throughout the city.

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1. INTRODUCTION

1.1 Statement of the Problem

Biophilic cities are (ideal) cities that have copious amounts of nature, as a part of their design (Beatley, 2010). They are cities in which residents expend the majority of their leisure time outdoors hiking, bicycling, or just admiring the aesthetics of their surroundings.

Prior research (Beatley, 2013; Sustainable Built Environment National Research Center, 2012) has revealed that Biophilic element reduce urban heat island effect, and greenhouse emissions while bringing the emotional and psychological benefits of nature into the urban environment. However, the mainstream biophilic literature (Beatley, 2010; Beatley, 2017; Reeve et al., 2011; Sustainable Built Environment National Research Center, 2012) is largely focused on North American and European cities, and therefore it lacks on the inclusion of non-western cities. Non-western cities include the ones located in the African and Asian continents. As United Nations (2014) analysis shows, cities in Asian continent show higher urban growth pattern than cities in other continent, thus it is expected that Asian cities are subjected to expand in their size and population as well. Against this backdrop, to complement the mainstream biophilic urbanism this research studied the different biophilic elements of the city of Seoul. The city of Seoul was chosen for this study due to several reasons:

1. Seoul is an international city, home of electronic companies such as Samsung and with an international population of about 340,000 people within the city proper (Statistics Korea, 2015).
2. The city of Seoul is one of the biggest metropolitan areas in the whole world. It is the nineteenth largest city proper and fifth largest metropolitan region in the world. The United Nations (2015) defines city proper as “a locality with legally fixed boundaries

and an administratively recognized urban status, usually characterized by some form of local government" (p.275). The United Nations (2016) identifies metropolitan regions as areas with high economic and social interconnectedness and that have an "interlinked commerce or commuting patterns" (p. 2). The Seoul capital area has a population of over 25 million. Thus, making Seoul a megacity, which are cities or metropolitan regions with a population of at least 10 million. This is an especially important trait because the number of megacities has tripled in the last twenty years (UN, 2014).

3. Korea is one of the few Asian countries considered to be developed. Only two countries, Korea and Japan, are considered to be developed countries by all the different development indicators and organizations (e.g. Human Development Index, Organization for Economic Co-operation and Development, International Monetary Fund advance economies). Because of this status, a city like Seoul and its actions might be looked as ideal examples of what to do by developing countries in Asian, such as China or India.
4. Finally, Seoul has been one of the few examples of how westernized cultures and globalization can coexists in harmony with Eastern traditional ideals and forms, such as Feng Shui theory and Confucianism. For example, the City of Seoul was initially design based on Feng Shui principles, and even though Western architecture might have arrived to the city, those principles are still guiding the location and layout of new development (Hong et al., 2007).

1.2 Objective & Research Questions:

The overall objective of this research is identifying to what extent the City of Seoul presents characteristics of those present in a biophilic city. Using participant surveys, spatial analysis, as well as an constructed nature projects inventory, to record at least one indicator in each of the four biophilic cities dimensions identified by the Biophilic Cities Network (2015) this study will answer the overarching question "How biophilic is Seoul?". As well, this study seeks to understand the following sub questions: 1) What percentage of the city are natural spaces?, 2) What percentage of city population lives within 300m of natural areas?, 3) How many major constructed nature projects have been started or completed in the city since 1996?, 4) What percent of the population visits parks or green spaces daily?, 5) What percentage of the population is part of a nature and/or outdoor-oriented clubs?, 6) Does the city have any a biophilic cities strategy, action plan, or equivalent?, 7) How has the city change its planning process, policies, regulations, guidelines, and/or public engagement and education to incorporate biophilic values and goals in it?, 8) What percent of the population spends at least 30 minutes of the day outside?, 9) What percent of the population participates in 30 minutes of physical activity outside per day?.

2. LITERATURE REVIEW

2.1 The Biophilia Hypothesis

Biophilia is a term that has become an important concept for researchers and academics in the last couple of decades. This term first appeared in *The Anatomy of Human Destructiveness*, a book written in 1973 by a German social psychologist Erich Fromm. Fromm described biophilia as "the passionate love of life and of all that its alive" (Fromm, 1973). While the term was used by other people at that time, it was not until a decade later, when the biologist Edward Osborn Wilson published his book *Biophilia*, that the term gained popularity. Wilson first defined biophilia as the "urge to affiliate with other forms of life" (Wilson, 1984), however, later he and Kellert (1993) redefined it as "the innately emotional affiliation of human beings to other living organisms. Innate means hereditary and hence part of ultimate human nature" (p.31). This last definition of the term biophilia is commonly referred to as the biophilia hypothesis.

The biophilia hypothesis claims that humans have cohabited and evolved closely to nature through millennia, and that this cohabitation has resulted in a close bond (Wilson & Kellert. This bond requires humans to keep in contact with other living organisms to have physical and psychological well-being (Kellert & Wilson, 1993). Ever since Kellert and Wilson (1993) published their book *The Biophilia Hypothesis* there has been a consensus about the existence of a nature-human connection. Some of the benefits that researchers have found are that the exposure to sunlight, green spaces and/or fresh air reduces stress (Leather et al., 1998), and promotes the early recovery from illnesses and surgery procedures (Ulrich, 1984; Mitrione, 2008) and increases overall physical and physiological health status (Nielsen & Hansen, 2007; Hartig et al 1991; De Vries et al 2003).

2.2 Biophilic Urbanism

With the movement of human population from rural to urban areas, to the point where more than 50% humankind lives in urbanized places (UN, 2014), it is not surprising to see an increasing interest in the creation of urban spaces with natural features, among urban designers and architects. This interest brought experts together from these fields, and their conversations lead to the creation and publication of *Biophilic Design: Theory, Science, and Practice of Bringing Buildings to Life* in 2008. Biophilic Design is "the deliberate attempt to translate an understanding of the inherit human affinity to affiliate with natural systems and processes…into the design of the built environment" (Kellert et al, 2008). The focus of this book is biophilic design at small scale such as room or buildings, however, it also features the first reference to biophilic urbanism, under the term of biophilic cities, by Timothy Beatley. Beatley argues that while the integration of natural elements in urban environments is crucial for the well-being of humans, it is not enough and that it is required to look to cities as whole ecosystems (Kellert et al, 2008; Beatley, 2009; Beatley, 2010).

Beatley defines biophilic cities simply as "a city that puts nature first in its design, planning, and management" (Beatle, 2009), however he recognizes that they are more than just that. Biophilic cities are ideal cities that have copious amounts of nature, as a part of their design. They are cities that work to restore that natural ecosystems lost while valuing existing ones. They are cities where residents expend the majority of their leisure time outdoors hiking, bicycling, or just admiring the aesthetics of their surroundings. In biophilic cities, the majority of the residents are able to recognize the species of fauna and flora and they enjoying the abundance of nature sounds and colors (Beatley, 2010).

It is important to note that at present, biophilic cities are ideal cities, therefore biophilic urbanism focuses on studying the different ways that nature can be integrated in a city by using biophilic elements. Biophilic elements can appear at different scales such as building, neighborhoods and/or region (Beatley, 2013). Table 1 shows a list detailing which elements can be found at each of the scales.

Dimension	Indicators
Building	Green rooftops Sky gardens and area atria Rooftop garden Green walls Daylight interior spaces
Block	Green courtyards Clustered housing around green areas Native species yards and spaces
Street	Green streets Urban trees Low impact development Vegetated swales and skinny streets Edible landscaping High degree of permeability
Neighborhood	Stream daylighting/stream restoration Urban forest Ecology parks Community gardens Neighborhood parks/pocket parks Greening greyfields and brownfields
Community	Urban creeks and riparian areas Urban ecological networks Green schools City tree canopy Community forest/community orchards
Region	Greening community corridors River systems/floodplains Riparian systems Regional greenspace systems Greening major transport corridors

Table 1. Biophilic city design elements across scales. Adapted from Beatley, 2013

Having natural infrastructure is essential to make a city biophilic. However, a city will not be considered truly biophilic until its residents acknowledge and interact with these spaces. They need to care about nature, wanting to spend time outdoors and devote time to restoring or improving existing and potential natural spaces (Beatley, 2013).

With the idea of study and understand how cities can become biophilic, and to provide more information to officials all over the world about biophilic cities, the Biophilic Cities Network was launched in the late 2013. The network launched with a small number of partner cities such as Oslo, Norway and Portland, Oregon, however, in 2015 their unveiled the guidelines for cities wishing to join the network, which has significantly increase significantly the number of participants such as individuals, organizations (e.g. BioPhilly), and partner cities (e.g. Austin, Texas). The Biophilic Cities Network (BCN) requires from its partner cities to pass a resolution, and record a minimum of five biophilic indicators. Partner cities must at least select one indication from each of the following dimension: 1) natural conditions, qualities, and infrastructure, 2) biophilic engagement, participation activities, and knowledge, 3) biophilic institutions, planning, and governance, 4) human health and well-being (BCN, 2015). The biophilic indicators are a set of proposed measures under which data can be collected across a set of locations in a standardized manner. Table 2 shows a detailed description of the four dimensions with their corresponding biophilic indicators.

Dimension	Indicators
Natural conditions, qualities, and infrastructure	- Percent of forest canopy coverage; - Percent of city population living or working within 300m of a green space, park, or other natural element; - ft^2/m^2 of green rooftops, green walls, and other vertical nature per 1000 population; - Number of new projects (public or private) of constructed nature, started or completed, over time.

Biophilic engagement, participation, activities and knowledge	- Percent of population visiting parks or green spaces daily; - Ability of residents to identify common species of flora and fauna; - Extent of basic eco- and bio-literacy among residents; - Extent of membership in nature and outdoor-oriented clubs and activities (e.g. birding clubs, neighborhood nature clubs, community gardening, native plants society, etc.)
Biophilic institutions, planning, and governance	- Percent of city budget devoted to nature conservation, restoration, and education; - Existence of a biophilic cities strategy, action plan, or the equivalent (e.g. a biodiversity action plan, green infrastructure plan or element in local comprehensive plan) and annual progress towards its goals; - Revisions to, and innovation in, development planning, policy, regulations, guidelines, and public engagement and education to incorporate and create biophilic values and goals through city planning, design, and development practice; - Percent of primary school pupils exposed to nature education; number of city schools with eco- or bio-literacy curricula; - Extent of evidence of leadership and support of global nature conservation, and nature conservation efforts in other cities [e.g. city-to-city aid agreements, participation in global conservation initiatives and conferences, etc].
Human health/well-being	- Percent of city population spending at least 30 minutes of the day outside exposed to urban nature; - Percent of population participating in 30 minutes of physical activity outside per day; - Percent of schools where children have access every day to nature play; - Percent of low-income and/or minority city neighborhoods with access to nature (within five-minute walk); - Measurable progress made to overcome inequitable or unfair distributions of urban nature through planning.

Table 2. Biophilic dimensions and indicators. Adapted from BCN, 2015.

2.3 History of Urban Planning in Seoul

Seoul has been inhabited for more than 2000 years. It became the capital of Korea in 1394. It was in this same year when King Taejo established the "Planning Board and Construction Authority for the New Capital and Palace", initiating the first ever urban planning agency in Seoul. The city grew in almost complete isolation from Western cultures until it decided to open its doors to Westerners in the late 19th century, which triggered the

modernization of the city. The city widened its streets to adapt itself to the automobile, introduced electricity, and created foreigners' quarters. However, the major changes came after the annexation of Korea as a colony to the Japanese Empire in 1910. From 1930 to 1950, several projects were undertaken in the city because of the enactment of the Joseon City Planning Act in 1934 (Seoul Metropolitan Government Department of Urban Planning, 2009).

However, most of the progress that the city of Seoul had experienced during the first half of the 20th century was almost completely erased during the Korean War. It took over a decade to start recovering from the consequences of the war, but with the enacted of the First and Second National Economic Development Plans the city of Seoul started growing again, expanding its boundaries for the first time to the south of the Han River, which is presently located in the middle of the city.

By the 1980s, the city of Seoul had become one of the largest cities in the world, and gained worldwide the recognition of being one of world's greatest international cities when it hosted 1988 Summer Olympics. After the 1988 Summer Olympics, the city of shifted its urban development policy focus from economic growth to sustainable development hopping to improve the environmental conditions and the quality of life in the city (In-hee, 2017). Under the new policy focus the city engaged in its first major nature recovery project, the Mt. Namsan Restoration project in the 1991, and it also enacted the first 5-year Plan for Park & Green which opened the Green Seoul Era (Seoul Metropolitan Government Department of Urban Planning, 2009).

The current urban master plan, the 2030 Seoul Plan, was enacted in 2014. This is the city's first ever urban master plan that had public involvement in its creation, rather than relaying just on experts and administrators like prior ones. This proves the city's entrance into a new era.

The plan has 17 goals grouped in 5 categories: People-oriented city of equal opportunity; Global city of cohabitation, with abundant jobs and vibrancy; Exciting city of culture and history; Safe, environmentally-friendly city; City of close community, residential stability and mobility (Seoul Solution, 2015).

2.4 Seoul's Parks and Green Spaces

Since its establishment as the capital of Korea, the City of Seoul has always been surrounded by multiple natural areas. Some of those natural spaces were even used for the layout of the city, due to their importance for the city prosperity according with Fengshui theory (Hong et al., 2007). The city was initially surrounded by 2 rings of mountains. The inner ring which is formed by the Bugaksan, Inwangsan, Naksan, and Namsan mountains, was used to create the Seoul wall. The Seoul wall surrounded the city and was a made primarily of stone. The mountains that formed the inner ring provided for spaces the inspiration that inspired scholars, while providing recreational areas for the city's residents, acting thus in a similar way as parks do in the present.

As Korea opened its doors to the western civilization at the end of 19th century, the first ever planned parks were created in Seoul (i.e. Pagoda Park, Mt Namsan Park) , primarily to satisfy the international population (Hwang, 2003). However, almost all the created parks were abandoned during the Second World War and the Korean War, and after South Korea recovered Seoul after the end of the Korean War, its parks were used to settled refugees (Kim, 2017). It was with the enactment of the Park Act in 1967 that parks regained their importance as essential parts of the city, which led to full-investment in parks and green spaces by the city in the 1970s (Hwang, 2003). This new investment phase escalated in the 1980s, which culminated when the

city created one of the biggest parks in the city today, the Olympic park, to commemorate the 1988 Olympic Games (Kim, 2017).

With the celebration of the 600th anniversary of the city, also with the enactment of local autonomy from the beginning of the 1990s, the City of Seoul embarked in several projects that would make the city greener and healthier for it citizens, the main project was the restoration of Mt. Namsan in 1991. When the first elected mayor of Seoul, Cho Sun, took office in 1995, several policies regarding green and park spaces were changed. In 1995, Mayor Cho stablished the Green Seoul Citizens' Committee, which in the present is composed of 94 members including experts, scholars, representatives of citizen groups, journalists, and government officials, etc. This committee uses the information it gathers form citizens and NGOs to make recommendations about the location of new green spaces, as well as the policies around them. The Green Seoul Citizens' Committee has established, executed, and evaluated environmental policies and has overseen the implementation of the action plans for the Seoul's Agenda 21.

Mayor Cho Sun nicknamed "grand master of public administration", led the shift from government-led policies to a resident-oriented plans, such as the 5-year Plan for Park & Green Spaces in 1996, which was the first plan in the city's history to involve public participation. Since that moment the City of Seoul has taken on several campaigns to make the city greener, such as the 'Plant 10 Million Trees", which aimed to turn the grey areas of the city into green full of life locations, or the "Greener 1 Million Pyeong" program which focused on creating public-private partnerships to increase the access of green areas to the general public. All this campaigns led to creation of the Green Seoul Bureau, and to the announcement of the 2013 Green City Declaration, where the city compromise on extending its green spaces outside of park boundaries in order to become a "park city" (Kim, 2017).

3. METHODOLOGY

This research was conducted using a convergent parallel method to create a comprehensive understanding of how biophilic Seoul is (see Figure 1). Convergent parallel research method is characterized for the independent collection and analysis of both quantitative and qualitative data, and the comparison of the results to see if the findings confirm or disconfirm each other (Creswell, 2013). The constructed nature projects inventory is the qualitative component of the study while the paper surveys and the spatial analysis are the quantitative ones.

The paper surveys were used to collect and analyze data related to two of the biophilic cities dimensions: 2) Biophilic engagement, participation, activities, and knowledge; 4) Human health & well-being. The spatial analysis was used to collect and analyze information pertinent to one biophilic cities dimension: 1) Natural conditions, qualities, and infrastructure. Finally, the constructed nature projects inventory was used to collect and analyze the information related to two biophilic cities dimensions: 1) Natural conditions, qualities, and infrastructure; 3) Biophilic institutions, planning, and governance. Finally, by combining the results of the four biophilic cities dimensions, it would be possible to determined how biophilic Seoul is.

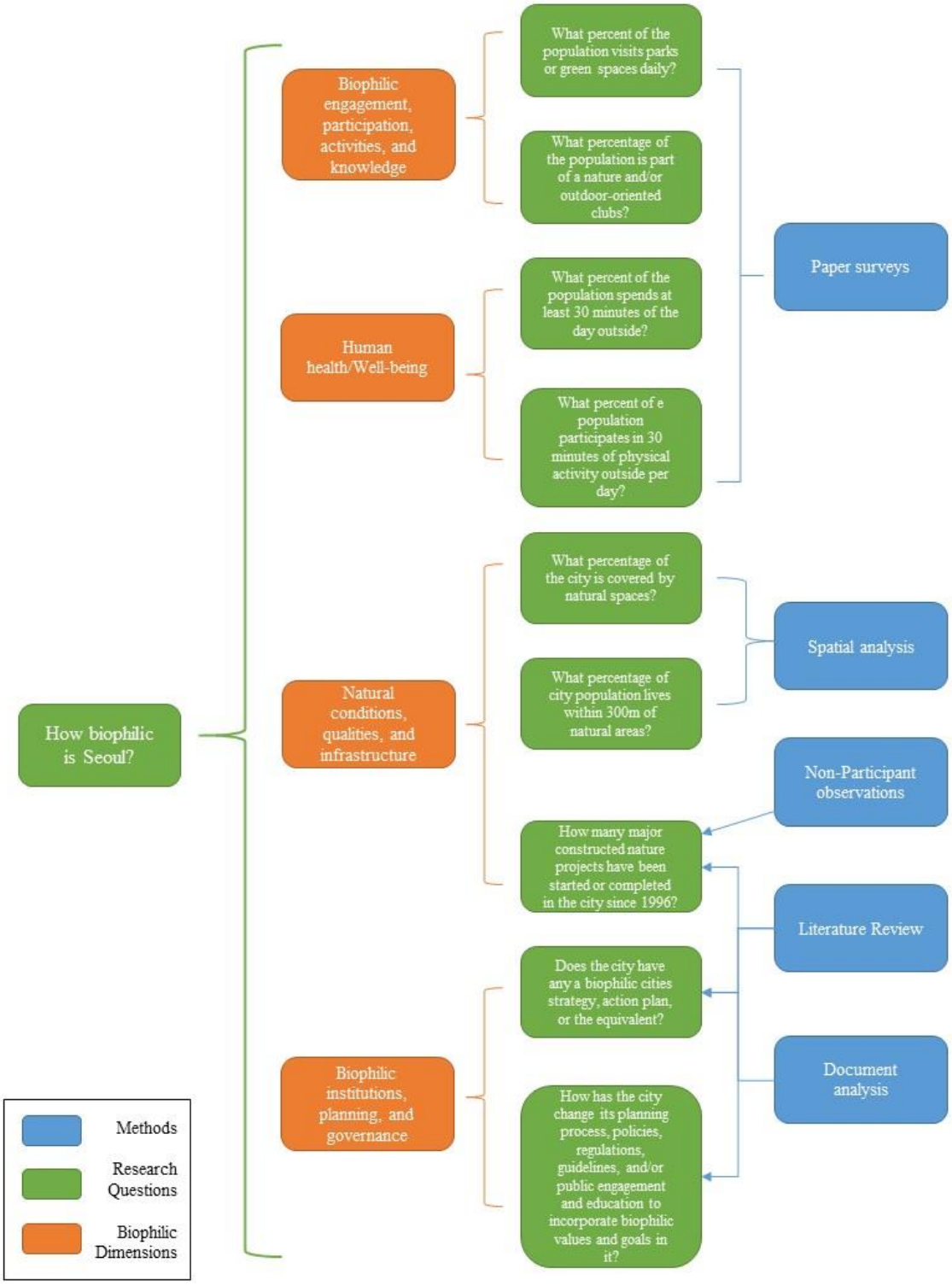

Figure 1. Relationship between research questions, biophilic cities dimensions and research methods.

3.1 Paper Surveys

The paper survey was composed of two different sections. The first section included questions about people's interaction with nature, while the second part was aimed towards understanding people's appreciation of nature by using the Connectedness to Nature Scale (Mayer & Frantz, 2004; Perrin & Benassi, 2009). The development of the survey was done in English, and it was later translated into Korean.

Since the population of Seoul was approximately 9.9 million in the 2015 Korean census, and the desired confidence interval of the survey answers was +/- 5% with a 95% confidence level, it was identified that a minimum of 384 surveys had to be collected (Statistic Korea, 2015; Dillman, Smyth, and Christian, 2014).

Surveys were collected at random location of Seoul at 14 different locations including subway exits, office districts, and city parks, during May 20th to July 19th 2016 in blocks of time ranging 1-5 hours based on location and avoiding the rainy days because of the format of the survey. The locations were selected because they were major pedestrian paths. At each of the locations, anybody approaching the researcher's location from the right side was asked to fill out the survey until someone stopped.

When someone stopped to fill out the survey, individuals were provided with a clipboard containing the information/consent form (Appendixes III-IV) on top and the survey (Appendixes I-II) under it. The information sheet explained that in order to fill out the survey, participants were required to either live or work (no matter whether temporarily or permanently) within the Seoul metropolitan region, and that they had to be born in the day they were filling out the survey in 1998 or sooner (to ensure that participants were 18 years of age by American standards). If asked, individuals were explained about the instructions and about the meaning of

any of the questions within the first section of the survey except for the words “outdoors” and “green spaces”. However, only clarification about the instructions of the second part of the survey was provided. No clarification was given to participants about any of the fourteen statements of the Connectedness to Nature Scale to avoid any possible influence of researcher’s personal beliefs over the survey results. After completing the survey, participants were told to keep the Ball State University pen they used to fill out the survey, and the search for new participants was restarted by asking people approaching the researcher from the opposite direction (left).

3.2 Spatial Analysis

The aimed of this analysis was to answer the sub-questions “What is the percent of natural areas coverage within the City of Seoul” and “What percent of the city’s population lives within 300m of natural areas”. All the Spatial analysis was conducted with ArcGIS 10.4.x. This analysis was conducted using data from two data sources:

- The total population of Seoul as well as the total population in each of Seoul’s districts was acquired for the 2015 Korean Census (STATISTICS KOREA, 2015).
- The city’s land use, and the districts and city boundaries were all part of the of the Seoul biotope shapefile which was sent to the researcher by students at the University of Seoul. Urban biotope mapping is a tool that has been widely used to create a dataset containing data about the different urban ecosystems (Lee et al., 2005). Seoul’s first biotope dataset was developed in 2000 as a planning management and policy tool (Hong et al., 2005).

To be able to conduct the desired analysis the following two assumptions were done:

- Rivers, streams, lakes, and open spaces are all different forms of natural areas that residents in Seoul have access to, whether is recreationally (e.g. riding a boat or camping) or exploratorily (e.g. watching or touching).

- Population is distributed equally across all the residential area within a district, therefore disregarding the differences in buildings heights, household multipliers and/or number of units within a specific development.

For a step-by-step guide please refer to Appendix V.

3.3 Constructed Nature Projects Inventory

This inventory was created to answer the sub-questions "How many projects of constructed nature have been completed or started since 1996", "What were the drivers in the creation of these constructed nature projects?", and "How are these spaces used?". This inventory was created following a multiple time-series case study approach (Yin, 2013). The data for the each of the cases was compiled through literature review, non-participant observations, and document analysis. The literature review was used to better understand the historical context as well as the legal and political framework of the city for each of the cases, the use of non-participant observation was used to understand the current layout and usage of each of the locations, while the document analysis for both things. Per Yin (2013) observational evidence is normally used to provide extra information as well as perspectives in the phenomena that is been studied. The non-participant observations were conducted between May 17th 2016 and July 24th 2016. For this research, non-participant observations were conducted by the researcher. These observations were done by seating down for blocks of twenty minutes in locations of the park that provided high visibility of the area. The observations were complemented with photographs taken throughout the park.

3.3.1 Historical context and cases selection

After a long period of economic and political recovery from the Korean War, in the late 80s the city of Seoul became one of the leading cities in the world. However, this prosperity came at a huge cost, namely the health of citizens and the overall environmental status of the city. To remediate the situation, in the late 1990s the Seoul Metropolitan Government changed the focus of its policies to become a sustainable development-oriented city with the hope of improving the environmental conditions and the overall quality of life in the city, culminating in the enactment of the 5-year Plan for Park & Green Spaces in 1996, the first plan in the city's history to account with citizen participation (Seoul Metropolitan Government Department of Urban Planning, 2009). It was with this focus that the city started allocating more resources into the Seoul Green Bureau and its respective divisions, and consequently several major environmental restoration and environmentally-friendly projects have been created since then.

4. RESULTS

4.1 Paper Surveys

4.1.1 Demographics and validity analysis/assessment

The median age of the respondents was 29 years old (Table 3), and 54 percent of them were female. The median age of the participants is 12 years younger than the projected median age of the city at the time of the data collection (Statistics Korea, 2017). The age distribution among survey participants can be seen on figure 2. The gender distribution of the respondents was almost identical to the to the projected gender distribution of the city at the time of the data collection (Table 4) (Statistics Korea, 2017).

	Number of Surveys	Median Age
Male	179 (46%)	31
Female	208 (54%)	26
Total	387 (100 %)	29

Table 3. Number of surveys and median age by gender.

	Median Age	Gender distribution	
Survey	29	46% Male	54% Female
City of Seoul	41	49% Male	51% Female

Table 4. Survey's and Seoul's median age and gender distribution.

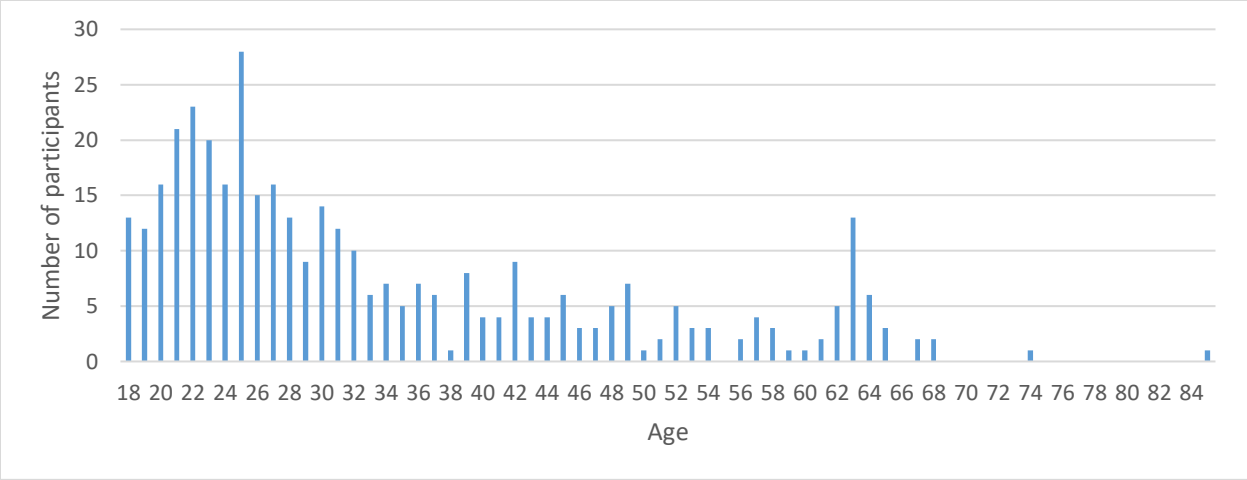

Figure 2. Age distribution among survey participants.

Despite the efforts to acquire a random sample of the Seoul's population, it can be inferred, by looking at the median ages of the survey participants and city of Seoul, that the population sample is not representative. This might have happened because of self-selection bias during the data collection. People that did not known English at all might have been reluctant to speak with the researcher or looking at the survey, despite being asked in Korean if they could do a survey. On the other hand, younger Seoulites, many of which have an advance comprehension of English, were less reluctant to stop and either look at the survey or ask the researcher about the purpose of the survey. Another reason that might have affect the self-selection process is that a lot of middle-age adults and elders are asked invited to fill out forms or questioners on the streets on a daily or weekly basis which has resulted in them ignoring such solicitations. Another possibility of this self-selection might have been the fact that young adults might have had more time on their hands because of being studying rather than working, and/or because they might not have kids to take care after work.

4.1.2 Part 1: Interaction with nature results

Participants were first asked about how much time of their day is spent outdoors. The word outdoors was up to each participant to interpret. No specific definition or clarification for the word outdoor was given, because of the research assumption that when a human it is outside of a building, in the open air, s/he is therefore interacting with some aspect of nature. This interaction can range from feeling the breeze of the air or the warmth of the sun in someone's face, to playing with animals (e.g. feeding deer at Seoul Forest), swimming in a river or sleeping under a tree. Surprisingly, nearly 90 percent of the participants spend at least 30 minutes daily outdoors (Table 5).

Q1. How much time of your day do you spend outdoors?	
Less than 30 minutes	43 (11%)
30 minutes – 1 hour	86 (22%)
1 - 2 hours	104 (27%)
2 – 3 hours	64 (17%)
More than 3 hours	90 (23%)

Table 5. Question 1.

The second question of the survey continue asked about the time spent outdoors doing some form of physical activity. As with first question, the term outdoor was left open for interpretation. The term physical activity was also open, as it has been widely proven that even the simplest form of physical activity, walking, has great amount of physiological and mental benefits when done outdoors and/or in nature (Barton et al., 2009; Johansson et al., 2011; Roe & Aspinall, 2011). Almost, 60 percent of the participants said to spend 30 minutes daily doing some sort of physical activity outdoors (Table 6).

Q2. How much time do you spend outdoors doing some kind of physical activity?	
Less than 15 minutes	74 (19%)
15 – 30 minutes	86 (22%)
30 – 45 minutes	68 (18%)
45 minutes – 1 hour	67 (17%)
More than 1 hour	92 (24%)

Table 6. Question 2.

The third question of the survey asked participants if they were part of any nature or outdoor-oriented groups. This question looked into the extend of membership into nature related groups because people that belong to this type of groups normally spend more time in or around nature, and therefore it is assume that they will care more about it. Impressively, more than 55% of the survey participants stated that they were indeed part of such groups (Table 7).

Q3. Are you part of any nature or outdoor-oriented group? (E.g. Bird watching, gardening club, neighborhood nature clubs, etc.)	
Yes	217 (56%)
No	143 (37%)
N/A	27 (7%)

Table 7. Question 3.

The fourth question of the survey looked into the visitation rates of parks and green spaces by the participants. Both green spaces and parks were included in the question because of the existence of nature locations within the city that were not parks, such as nature trails, riverfront walks, and rood gardens, that allow for communion with nature in one way or another. Only 16 percent of the participants mention the visit such spaces daily, however, over 70 percent said to visit green spaces at least once a week (Table 8).

Q4. How often do you visit public parks or green spaces? (E.g. local area?)	
Everyday	63 (16%)
Every other day	43 (11%)
Twice a week	81 (21%)
Once a week	100 (26%)
Every other week	20 (5%)
Once a month	42 (11%)
Less than once a month	38 (10%)

Table 8. Question 4.

The last question of part one looked into whether participants did actively garden or grow any food. The reason for considering gardening activities in the City of Seoul was that it requires more commitment than being just part of outdoor-oriented groups, thus increasing the benefits of being with contact with nature as well as providing a higher awareness level about environmental issues and solutions (Clayton, 2007; Hawkins et al., 2013). Surprisingly, more than 40 percent of the participants said that they actively garden/grow food. This rate was higher than expected because of the lack of land available for such purposes within the city of Seoul (Table 9).

Q5. Do you actively garden/grow any kind of food? (E.g. community garden, balcony gardens, etc.)	
Yes	158 (41%)
No	185 (48%)
N/A	44 (11%)

Table 9. Question 5.

4.1.3 Part 2: Connectedness to Nature Scale

The second part of the survey was to measure people's appreciation for nature by using the Connectedness to Nature Scale. The Connectedness to Nature Scale (or CNS) was first proposed by Mayer and Frantz (2004) as "a measure of designed to tap an individual's affective,

experiential connection to nature" (p. 504), and at the end of their multiple studies the conclude that "in general, there is a moderately strong positive relationship between the CNS and eco-friendly actions, meaning that while this relationship might not hold for everyone it does hold for most people and in a rather robust manner" (p. 512).

Perrin and Benassi (2009) challenge the idea that the Connectedness to Nature Scale measures an emotional connection. In their studies, they conclude that instead the "CNS is a measure of people's beliefs about their connection to nature" (Perrin & Benassi, 2009, p. 439), thus measuring cognitive belief rather than an emotional one. This change, however, does not affect the capabilities of the scale to predict eco-friendly behaviors which is why the CNS is still one of the most used nature connectivity scale and it has even been translated to other languages successfully (Olivos et al., 2011).

The Connectedness to Nature scale is composed of 14 questions, all of which use a 5-point Likert scale. The summary of participants' answers can be seen on table 10. While the translations were assumed to be completely accurate, because most of the surveys were in Korean, the internal reliability of the survey was calculated using Cronbach's alpha. As mentioned by Mayer and Frantz (2004) questions 2, 12, and 14 and a negative connotation and therefore they were reverse scored before any calculations. They analysis showed the scale has an acceptable alpha ($\alpha = 0.775$) which makes the Korean-translated CNS form a valid and reliable measure of connectedness in a Korean-speaking context. The mean connectedness was 3.60 with its SD= 0.57 thus showing a small inclination towards nature among the participants.

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
I often feel a sense of oneness with the natural world around me.	59 (15%)	86 (22%)	165 (43%)	64 (17%)	13 (3%)

I think of the natural world as a community to which I belong.	105 (27%)	100 (26%)	126 (33%)	43 (11%)	13 (3%)
I recognize and appreciate the intelligence of other living organisms.	141 (36%)	105 (27%)	87 (23%)	27 (7%)	27 (7%)
I often feel disconnected from nature.	31 (8%)	47 (12%)	123 (32%)	111 (29%)	75 (19%)
When I think of my life, I imagine myself to be part of a larger cyclical process of living.	108 (28%)	119 (31%)	111 (29%)	37 (9%)	12 (3%)
I often feel a kinship with animals and plants.	114 (29%)	120 (31%)	100 (26%)	38 (10%)	15 (4%)
I feel as though I belong to the Earth as equally as it belongs to me.	102 (26%)	90 (23%)	125 (32%)	53 (14%)	17 (5%)
I have a deep understanding of how my actions affect the natural world.	91 (23%)	103 (27%)	139 (36%)	47 (12%)	7 (2%)
I often feel part of the web of life.	100 (26%)	107 (28%)	139 (36%)	31 (8%)	10 (2%)
I feel that all inhabitants of Earth, human, and nonhuman, share a common ‘life force’.	110 (28%)	99 (26%)	120 (31%)	45 (12%)	13 (3%)
Like a tree can be part of a forest, I feel embedded within the broader natural world.	128 (33%)	113 (29%)	107 (28%)	32 (8%)	7 (2%)
When I think of my place on Earth, I consider myself to be a top member of a hierarchy that exists in nature.	59 (15%)	56 (15%)	117 (30%)	82 (21%)	73 (19%)
I often feel like I am only a small part of the natural world around me, and that I am no more important than the grass on the ground or the birds in the trees.	66 (17%)	61 (16%)	131 (34%)	86 (22%)	43 (11%)
My personal welfare is independent of the welfare of the natural world	16 (4%)	15 (4%)	95 (25%)	90 (23%)	171 (44%)

Table 10. Connectedness to Nature Scale results.

After proving its validity, the Connectedness to Nature scale was used to measure whether the assumptions made about people membership to nature groups and their eco-friendly behavior, as well as people that garden/grow food and their eco-friendly-behavior was true. To test these assumptions, a one tail t-test was calculated using the overall survey participants as the

population and the participants that garden and/or that are members of nature/outdoor-related groups as the samples. In each of the cases where the t-test was conducted, a significant difference between the population average CNS and the sample's average CNS was found (Table 11).

	Connectedness to Nature Scale		Number of Individual	T-score
	Mean	Standard Deviation		
Survey participants	3.569	0.565	387	N/A
Individuals that garden/Grow food	3.747	0.538	158	4.157*
Individuals that are part of nature/outdoor-oriented groups	3.713	0.566	217	3.737*
Individual that who garden/Grow food and are part of nature/outdoor-oriented groups	3.813	0.562	117	4.678*
Individuals that don't garden/Grow food	3.396	0.558	185	-4.235*
Individuals that aren't part of nature/outdoor-oriented groups	3.371	0.511	143	-4.648*
Individuals that don't garden/Grow food and aren't part of nature/outdoor-oriented groups	3.306	0.547	100	-4.811*

* Statistically significant at $\alpha = 0.0005$

Table 11. Connectedness to Nature Scale by groups.

4.2 Spatial Analysis

The overall percentage of natural areas coverage of the City of Seoul was 37.38%. The area of natural spaces per capita in the Seoul was 22.97m^2 which well above the recommended minimum open space per capita (9m^2) by the World Health Organization (2010). However, the percentage of natural areas coverage and natural spaces per capita are not equally distributed throughout the city, with 2 district have less than 9m^2 available per capita.

District	District's Area (Sq m)	Natural Spaces Area (Sq m)	Population	Percentage of Natural Spaces	Area of Natural Spaces per Capita (Sq m)
Seoul	608,655,052.76	227,496,967.02	9,904,312	37.38%	22.97
Dobong-gu	20,777,305.08	10,792,727.56	340,095	51.94%	31.73
Dongdaemun-gu	14,588,496.46	1,950,855.51	364,787	13.37%	5.35
Dongjak-gu	16,456,814.00	4,420,956.08	407,894	26.86%	10.84
Eunpyeong-gu	31,333,170.80	15,439,021.04	478,374	49.27%	32.27
Gangbuk-gu	23,818,758.49	13,803,294.12	319,992	57.95%	43.14
Gangdong-gu	25,235,747.84	10,252,607.01	444,385	40.63%	23.07
Gangnam-gu	39,703,141.17	13,130,526.55	541,688	33.07%	24.24
Gangseo-gu	42,076,847.34	14,008,528.21	570,507	33.29%	24.55
Geumcheon-gu	12,945,518.08	3,435,186.29	250,690	26.54%	13.70
Guro-gu	20,096,105.09	5,199,087.85	444,832	25.87%	11.69
Gwanak-gu	29,968,580.72	15,196,057.67	519,622	50.71%	29.24
Gwangjin-gu	17,873,626.06	6,714,841.11	368,199	37.57%	18.24
Jongno-gu	23,125,332.82	11,411,182.16	161,521	49.34%	70.65
Jung-gu	9,980,352.27	1,725,218.97	128,478	17.29%	13.43
Jungnang-gu	18,314,348.28	5,948,553.17	403,237	32.48%	14.75
Mapo-gu	23,479,089.66	8,314,160.62	381,330	35.41%	21.80
Nowon-gu	35,754,652.92	17,619,858.51	562,996	49.28%	31.30
Seocho-gu	46,955,082.65	22,156,751.86	420,804	47.19%	52.65
Seodaemun-gu	17,812,965.32	6,091,998.17	308,768	34.20%	19.73
Seongbuk-gu	24,876,522.20	8,635,297.12	456,844	34.71%	18.90
Seongdong-gu	16,421,743.26	4,263,559.36	295,006	25.96%	14.45
Songpa-gu	33,108,408.56	8,552,636.88	634,941	25.83%	13.47
Yangcheon-gu	17,345,430.02	3,299,457.41	465,512	19.02%	7.09
Yeongdeungpo-gu	24,639,161.83	8,638,803.09	406,528	35.06%	21.25
Yongsan-gu	21,967,851.82	6,495,800.68	227,282	29.57%	28.58

Table 12. Nature areas coverage and nature per capita by district.

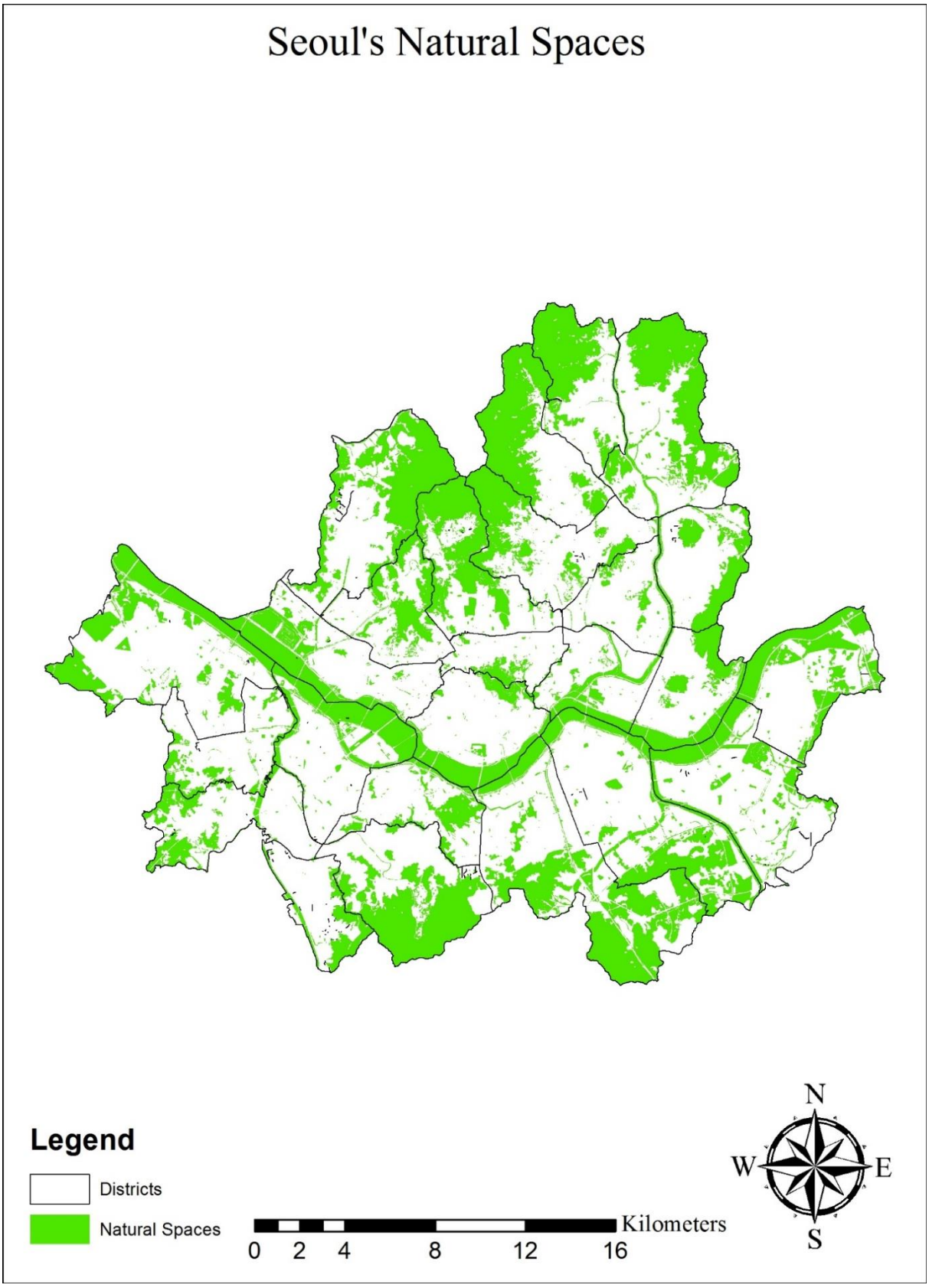

Figure 3. Map of Seoul's Natural Spaces

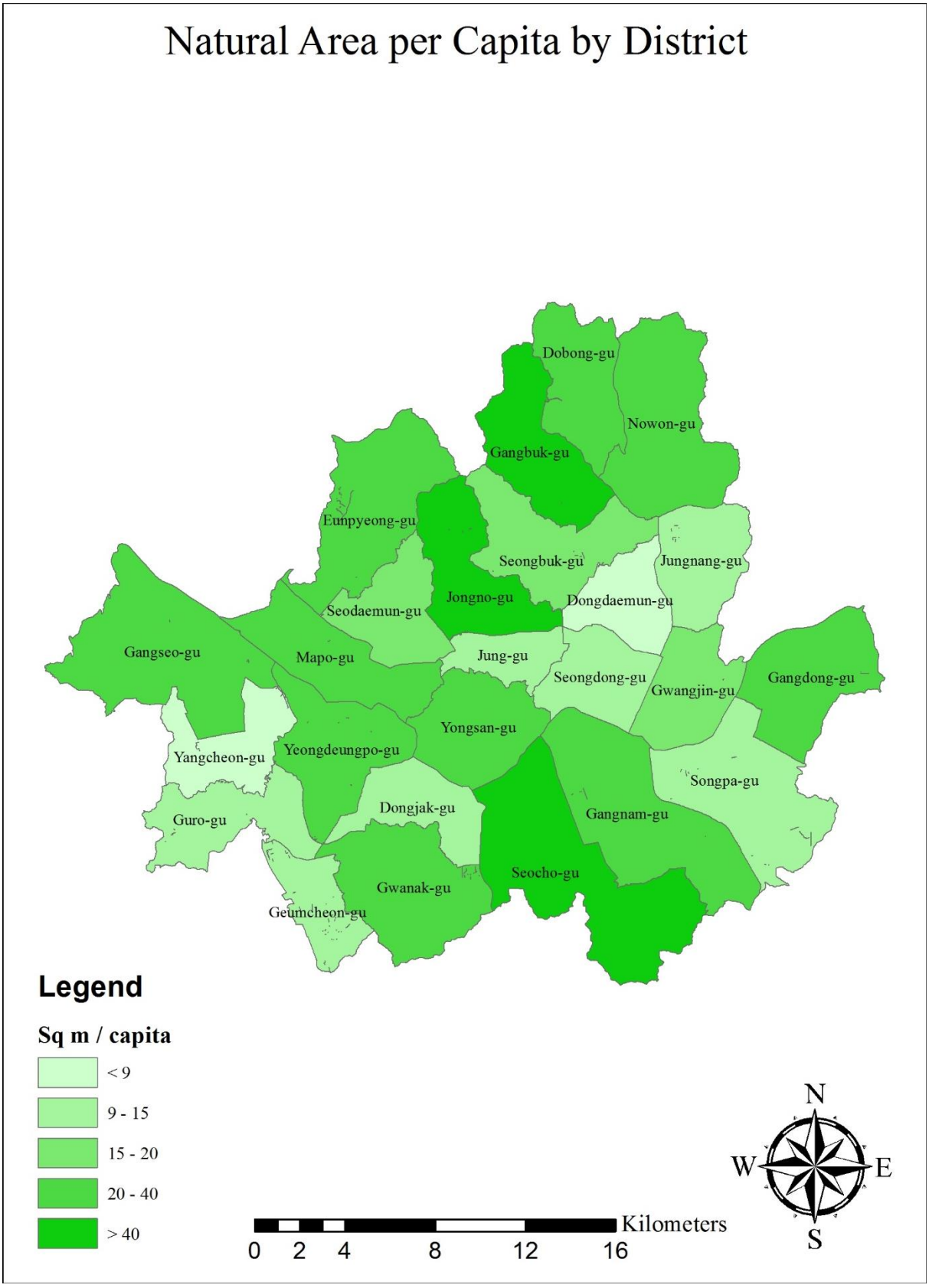

Figure 4. Map of Seoul's natural area per capita.

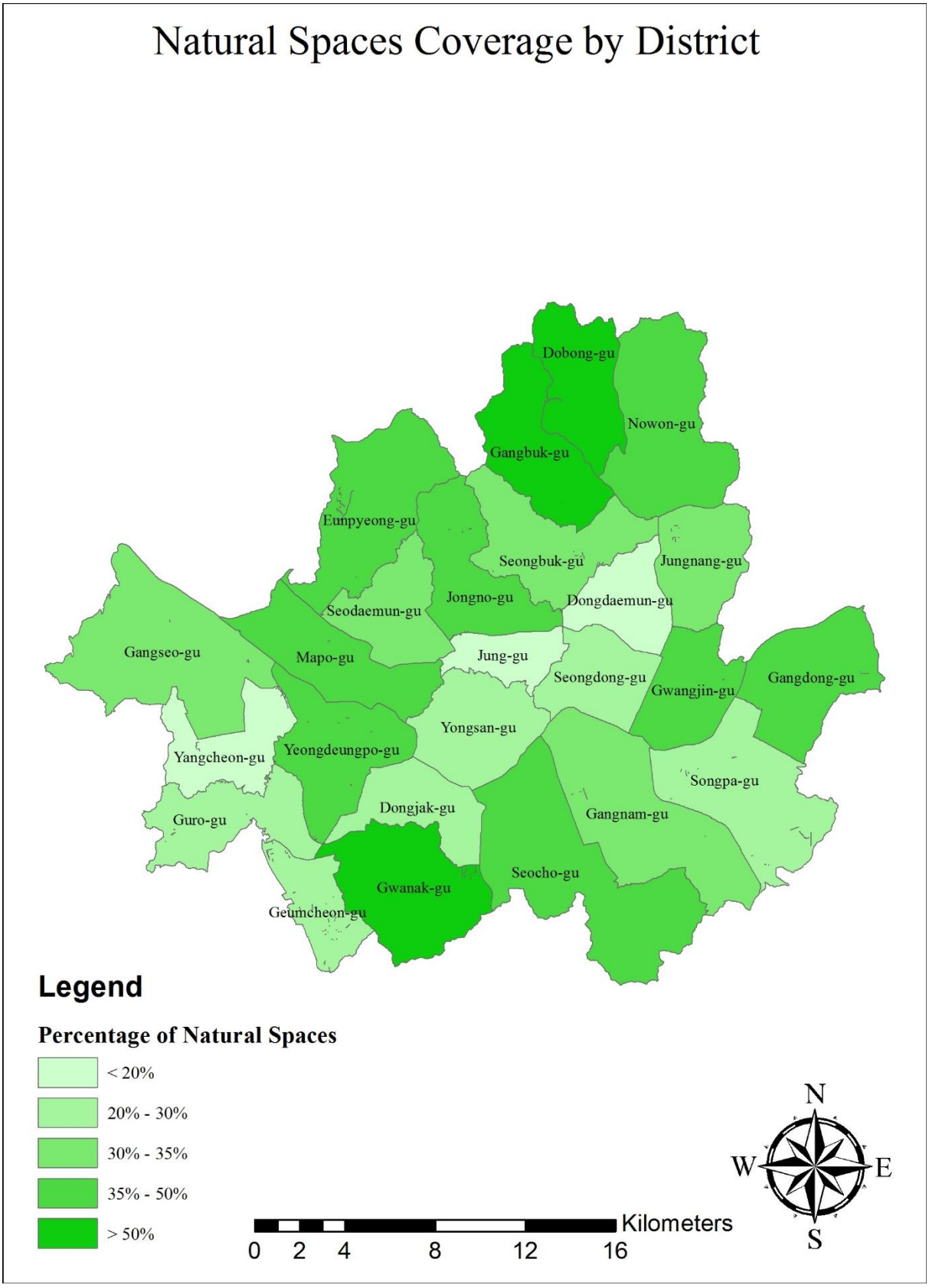

Figure 5. Map of Natural Spaces Coverage by District

The overall percentage of residents living within 300m of natural spaces in the City of Seoul was 94.39%, which is quite an impressive number. However, while the number of residents without access to nature was relatively small, almost 40% of those residents live in two districts, Gangdond-gu and Jungnang-gu.

District	Residences Total Area (Sq m)	Area of Residences Within 300m of a Natural Areas (Sq m)	Population	Percentage of Population Living within 300m of Natural Spaces	Population Without Access to a Nature Within 300m
Seoul	200,389,935.92	189,597,778.19	9,904,312	94.39%	555,702
Dobong-gu	6,722,628.64	6,660,158.53	340,095	99.07%	3,160
Dongdaemun-gu	6,929,324.40	6,607,394.08	364,787	95.35%	16,948
Dongjak-gu	7,795,631.84	7,693,904.47	407,894	98.70%	5,323
Eunpyeong-gu	10,569,104.91	10,327,125.74	478,374	97.71%	10,952
Gangbuk-gu	7,037,694.40	6,792,531.57	319,992	96.52%	11,147
Gangdong-gu	8,374,074.70	5,731,022.19	444,385	68.44%	140,258
Gangnam-gu	13,016,883.37	11,914,325.71	541,688	91.53%	45,882
Gangseo-gu	10,033,901.81	9,572,567.54	570,507	95.40%	26,231
Geumcheon-gu	4,710,788.09	4,303,666.94	250,690	91.36%	21,665
Guro-gu	7,867,168.25	7,239,996.56	444,832	92.03%	35,462
Gwanak-gu	9,417,874.17	9,079,061.64	519,622	96.40%	18,693
Gwangjin-gu	7,000,105.59	6,544,106.25	368,199	93.49%	23,985
Jongno-gu	6,074,259.56	6,074,259.56	161,521	100.00%	0
Jung-gu	2,389,478.44	2,370,165.69	128,478	99.19%	1,038
Jungnang-gu	7,697,567.69	6,173,411.13	403,237	80.20%	79,843
Mapo-gu	7,999,218.89	7,289,886.33	381,330	91.13%	33,814
Nowon-gu	9,519,944.25	9,519,944.25	562,996	100.00%	0
Seocho-gu	11,304,404.56	11,150,314.46	420,804	98.64%	5,736
Seodaemun-gu	7,090,682.51	7,077,292.80	308,768	99.81%	583
Seongbuk-gu	11,386,280.57	11,168,258.12	456,844	98.09%	8,748
Seongdong-gu	4,683,990.53	4,628,403.51	295,006	98.81%	3,501
Songpa-gu	10,753,391.87	10,074,153.82	634,941	93.68%	40,106
Yangcheon-gu	9,079,462.39	9,016,191.57	465,512	99.30%	3,244
Yeongdeungpo-gu	6,433,555.19	6,175,980.57	406,528	96.00%	16,276
Yongsan-gu	6,502,519.28	6,413,655.16	227,282	98.63%	3,106

Table 13. Resident's access to nature.

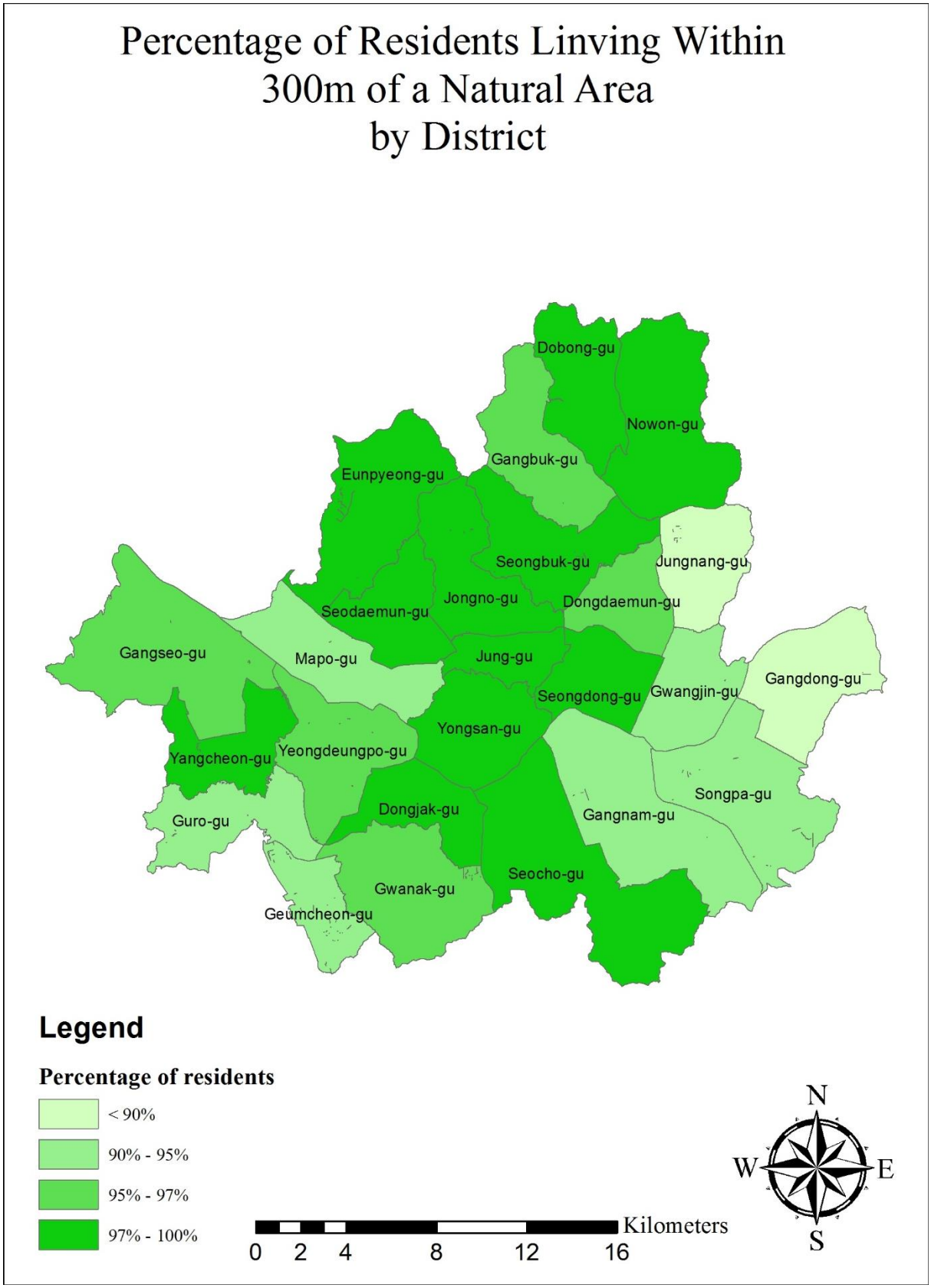

Figure 6. Map of residents living within 300m of natural spaces.

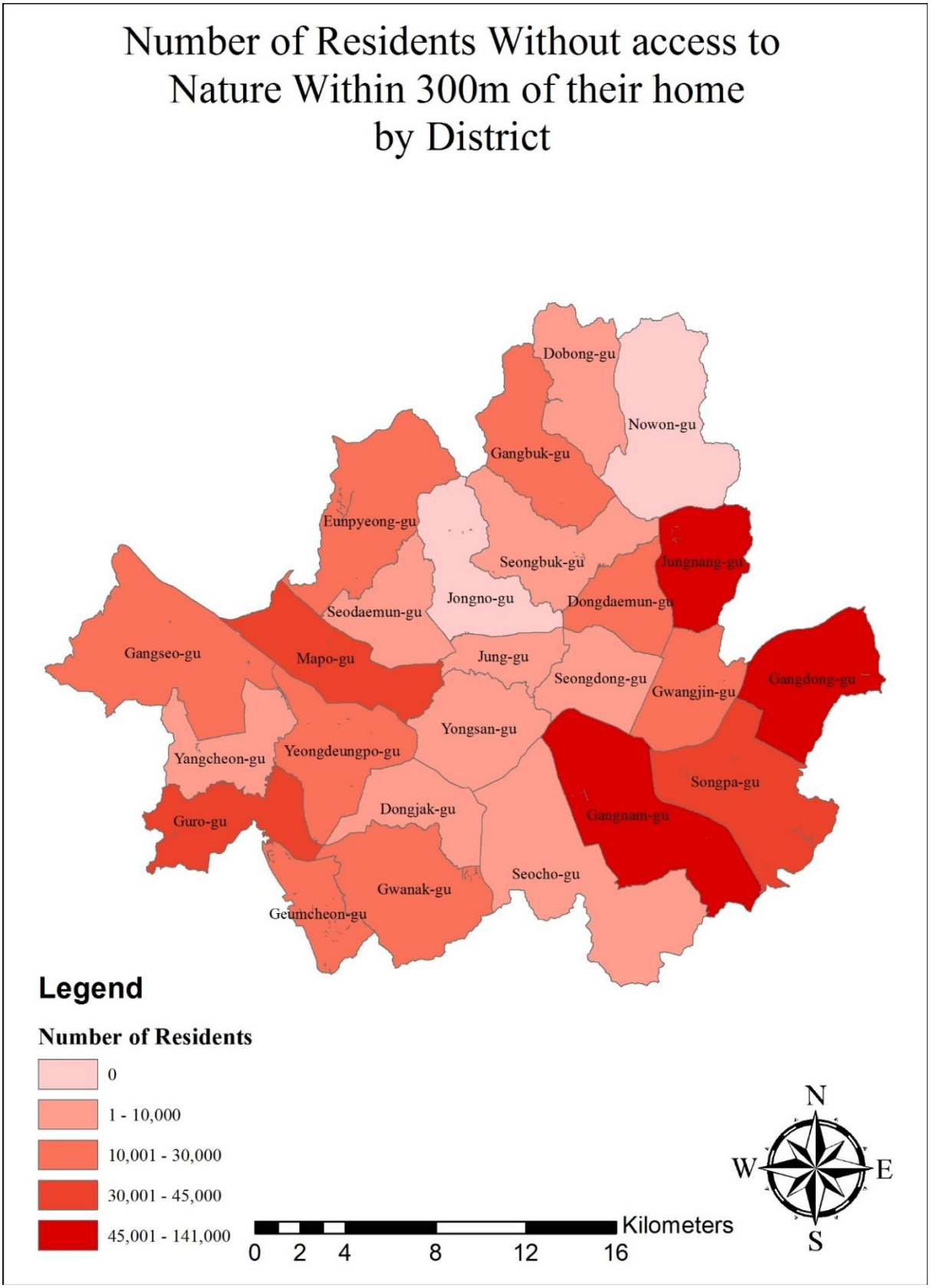

Figure 7. Residents without access to nature within 300 of their home.

4.3 Constructed Nature Projects Inventory

4.3.1 Gildong Ecological Park

Located in the Southwest part of the city, the Gildong Ecological Park provides access to one of the most pristine forms of nature available to Seoul's residents. The restoration of the wetland habitat that this ecological park was developed around was a direct result of the 1996 5-year recreation plan. The restoration of the habitat to its current condition, as well as the construction of the park took started in 1997, and the park opened its doors in May 20th 1999. Since its opening one of the major objectives of the park has been providing citizens with a healthy ecological space that will remind them of the importance of the environment. To achieve that goal while ensuring the pristine condition of the habitat within the park, a reservation system is used to admit only 200 visitors throughout each given day.

Figure 8. Gildong Ecological Park. July 12th, 2016

The park is divided in five sections. The first section is the park plaza, where visitors can find the visitor information center and the outdoor exhibition and observation area, which serves as the education center for incoming groups. The second section of the park is the marsh area, a place where visitors can observe several species of insects, amphibians, and marsh vegetation. The third section is the forest area, a place designed for visitors not only to observe the fauna and flora typical forest that used o exist in the region, but to provide also visual representation of the different stages of habitat restoration. The fourth section is the grassland area, showcases the types of adaptable plants and animals that can be found in the

areas surrounding rural Korean settlement. The last section of the park is the reservoir area, which was created with a two-fold purpose: to retain and secure water for the park year-round, and to provide habitat for the several types of bird species that stop in Seoul.

4.3.2 Seonyudo Park

Located in the west side of the city, the Seonyudo Park occupies one of the Islands located in the Hangang River. This park used to be one of the city's water treatment plants, which operated from 1978 until it was closed in November 2000. The city government decided to convert the plant into a water themed park as part of the "New Seoul, our Hangang" project, which aimed to offer nature to Seoul's residents by restoring the ecological value of the Hangang river. It was decided that most the water plant structures had to be maintained and incorporated into the design of the park. The park opened to the public on April 26th 2002.

This park mixes beautiful plants with the old structures of the treatment plant creating unique landscapes. One of these landscapes is the so called "green columns", which is located next to the exhibition hall. Another example of these unique landscapes is the Garden of time. This garden is composed by two different levels. The first one is the ground floor, where people can walk around in between what used to be the connected pools of the treatment plant, that are now cover by vegetation and beautiful flowers. The second level is form by a set of bridges that go across the top side of the pools and from where it is possible to see the layout of the pools, etc. Another

Figure 9. Seonyudo Park. May 26th 2016.

interesting place is the water purification playground, where kids can plain with a set of small water retention pools while their parents rest on the benches under the trees. The park also counts with green houses that are the home of some tropical plants. This park also counts with an Environment Studio, which is used as a classroom to teach students and residents about the Fauna and Flora of the Hangang river, among other things. Finally, on the western part of the island there is a beautiful wooden deck that is frequently visited by young couples. The deck has a nice wooden bridge on the southern part that connects the island with one of the Hangang river parks.

4.3.3 World Cup Park

The World Cup Park is in the western border of the city, in the area where one of the city's landfills used to be. The landfill operated between 1978 and 1993, and after its closing it left two big trash mountains and a contaminated river behind. After its closure, the city government went through a thorough planning process that culminated with the creation of landfill recovery project in 1996. The major focus of the project was to cover the landfill and stabilized it so it could be restored into a natural area in the future. Several meetings were held with both residents of the area and experts, to see what could be done with this land. The result was the idea of transforming the landfill into a park. In order to do so the city covered the two garbage mountains with an impermeable film to promote the fermentation of organic materials. In order to collect the methane created in the decomposition process, several pipes were located throughout this mountain. The pipes lead into a heating/electric plant that provides energy to the neighborhood. After waiting for 6 years for the garbage mountains to stabilize, the construction of the parks started. The World Cup Park opened in May 1st 2002, just in time for the 2002

Soccer World Cup tournament that was hosted in Seoul. This mega park is composed of 5 smaller ones:

Figure 10. Pyounghwa Park. May 24th 2016.

Pyounghwa Park: This park, whose name translates to "Peace park" is the one located further east and it is the closer one to the world cup stadium. The most important feature in the park is the Nanji pond, which effluent connects with the hang river. This pond his home of several species of aquatic plants and animals, and acts as the major ecological attraction. The second most significant area is the UNICEF plaza located adjacent to the pond. This plaza is where the two cafes/convenience store are located and it acts as the mayor gathering point both during the day and night. The plaza counts with several a wooden benches and platforms where families and friends gathered to eat and pass the day while enjoying the view and the microclimate provided by the Nanji pond. Another significant parks of this park are the Hope forest, which provides a great shaded area where young couples meet to have a romantic date, and finally the Seoul Energy Dream Center, a building that provides 3 floors full of interactive educational materials about renewable energy and green technologies.

Haneul Park: This park, whose name translates to "Sky park" is located to the west o of Pyounghwa park to which is connected by a bridge full of flowers on the side. It is in this park where the highest point of the World Cup park is located (which is 96 m high from the lowest point). On the sides of the park several wind turbines were located and are used in the present to provided energy to all the lamps and guard posts of the World Cup park. The park is form of

several high grasses cut by several paths. All these paths go to either the observation desks located on the sides or to the big metallic “bowl structure” that is located close to the center. The top part of this structure is the highest point accessible for visitors. From this point several hidden running-horses’ sculptures can be appreciated in between the grasses while hearing the wind moving the plants. However, the most attractive part of this park are the butterflies moving around the plants.

Figure 11. Haneul Park. May 24th 2016.

Figure 12. Noeul Park. May 24th 2016.

Noeul Park: This park whose name translates to “Sunset park” is located on top of what used to be the western mountain of the landfill. This park is probably the most interactive one. It counts with an 18 holes’ golf course, that only allows wooden sticks to be used, it also has an art lawn, composed by several sculptures next to which a family camping area is located. The most interesting part of this park for kids might probably be that it is the home of interesting wildlife such as raccoons, and leopard cats (which can be seen on the edges and around the ecological pond), while parents and young couples might prefer the beautiful sunsets on the roof of the café.

Nanjichon Park: This park is located north form the Haneul and Noeul parks where the Nanjichon stream passes thru. The stream used to be highly contaminated with raw sewage and

pollutants that was off from the landfill, however in the present there are not traces of any contaminant. The park counts with some trails that go next to the stream, and a connection of wooden low observation desks in where small ponds are form. While walking on this trails one is surrounded by nature without any sign of buildings or cars. This park also counts with a huge green lawn, for people to gathered, tennis and basketball courts, that can be rented by the hour, and what seem the most utilized area of all the part, several small pockets with exercising machinery, which seems to be used both by the elders and mid-agers of the area.

Figure 13. Nanjichon Park. May 24th 2016.

Figure 14. Naji Hangang Park. June 2nd 2016

Naji Hangang Park: This park is located on the southern part, and has connections with all but the Nanjichon park. This park was constructed as a part of the Hang river restoration project. The park counts with a mirror fountain, that on sunny days when ejects water a rainbow can be seen in it. It also counts with a camping site, where people can camp and do some barbequing, but what the most interesting feature is that it has a designated area where people can swim in the Hangang river (which is not normally allow in most ofthe other Hangang river parks).

4.3.4 Cheonggyecheon Stream

The Cheonggyecheon stream is a body of water that crosses from west to east the oldest part of the city of Seoul, and ultimately goes into the Hangang river. This stream has play an important part in the economic development of the city since its beginnings. During the Joseon Dynasty the stream created several floods during the monsoon seasons, therefore a division was created to maintain the river banks and to ensure the river wouldn't flood into houses. In the 18th century an office in charge of dredging the river was created to remove all the sediments coming from the mountains and from centuries of wastewater inflow. In the early 1900s, several citizens were requesting the covering of the stream as its waters, that were just mainly sewage, produce a horrible small. However, it wasn't until after the independence of Korea form Japan that covering up of the stream started. The government covered the stream in 1958, and in 1971 and elevated highway was added. The road and highway quickly became the major access to the city, making the Cheonggyecheon area the busiest and noisiest one of all Seoul. While in the 1970s the area was regarded as a successful example of modernization, in the 1990s citizens started to look at the area as a source of heavy traffic, and health and environmental issues. This led to the proposal of the restoration of the Cheonggyecheon river during the 2002 mayoral race.

The restoration of the stream started soon after the elections and it was finished in only 27 months, opening its doors in September 30th 2005. The restore part of the stream is 5.84 km long and connects on the east with the parts of the stream that were never covered. The stream s home of several plant and animal species and provides the citizens with a nice hiking trail in both side of the stream. On the upper part of the stream the water is clearer and it is in here where multiple residents can be seen cooling down with their feet on the water while listening to stream

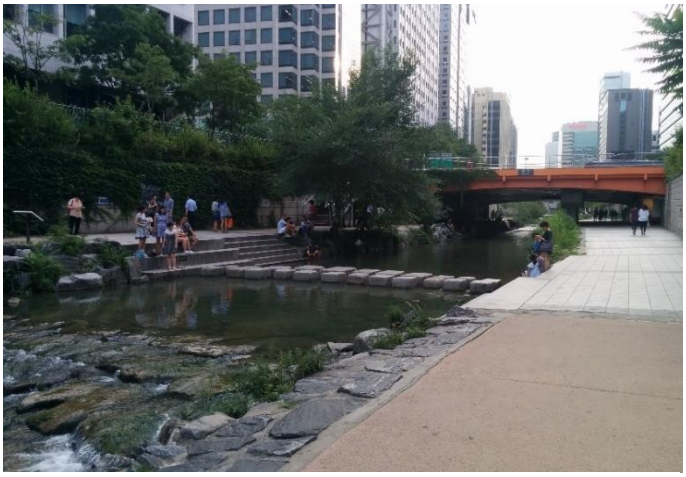

Figure 15. Cheonggyecheon Stream. July 9th 2016.

performances. On the medium and lower course of the river, the river becomes more naturalized and wider, with less opportunities to access the water with your feet, but providing the additional entertainment of feeding the fish and the birds. The whole area acts as a cooling corridor during warm summer days, with temperatures averaging 4-5 °C lower than outside the trail (Kim et al., 2009). Also, the stream trail features different traditional art under some of the bridges merging the historical, cultural and natural aspects of the stream together.

4.3.5 Seoul Forest

Located on the Eastern part of the city known as Ttukseom which means "Island of the ceremonial flag". This area used to be a royal hunting ground during the Joseon Dynasty. It is in this area where the first ever city's water purification plant was in 1908. A renovated and functioning version of that plant can be found in the middle of the park. Later, after the industrialization of the area, the Seoul Horse Racetrack was opened, however the area became popular after the establishment of a sport park next to the horse track in 1986. The area became a physical exercise paradise for adults and elders that looked for some outdoor leisure activities. In the early 2000s the city decide that it was time to change the area and an international design competition was launch for the Seoul Forest. The master plan for the Seoul Forest was selected in January 2003 and in December of that year the construction of the park started. Several community tree planting activities were held by the Seoul Green Trust organization, and thanks to what the park could be opened in June 18th 2005. The Seoul Green Trust organization created

a division called the Seoul Forest Park Conservancy, which has overseen the operation of the park since its opening in collaboration with the Seoul Metropolitan Government.

The Seoul Forest is the biggest park in the city of Seoul and since its construction it has become a city staple both for tourists and residents. The park was the city's attempt to create a "central park" in Seoul, and so far, it seems to have achieve its goals. The Seoul forest is divided in 5 thematic parks:

Figure 16. Seoul Forest-Culture and Arts Park. June 28th 2016.

Culture and Arts Park: This park is in the center of the Seoul forest acts as the gateway to the area. This area counts with several amenities for kids and adults. The first features that can be seen while entering the park are the horse statues that commemorate the old horse racing track, and just behind them a huge splash fountain. This fountain was design as a "standing pool" in where both kids and adults can refresh themselves in a warm day. Next to the fountain are two changing rooms/tents so that people can change into their swimsuit in them for a better enjoyment of the fountain. On sunny days, this place is full of people, with kids getting wet while their parents enjoy a nice conversation on the shade. Located just right behind the splash fountain, a sculpture garden can be found. Next to it is one of the most interactive features of this park, and outdoor theater. This theater houses concerts during the weekends. Other significant features of this park are the sport and exercising area, a lake with a cafeteria, a family yard (where people gather to eat take out on the weekends), and what is probably favorite place

for kids (after the splash fountain), the wooden and water playgrounds. In this two playgrounds kids can enjoy activities such as climbing a wall, or drilling for water.

Figure 17. Seoul Forest - Eco forest Park. June 28th 2016.

Ecological Forest Park: This park is located on the western part of the Seoul Forest and was created with the goal of bringing people closer to nature. To achieve this goal, the park counts with 3 features. The first one is the "Hill of Wind" where one can stop even in the hottest day of the summer and cool down by the breeze produce by the Hangang river. In order to make the experience more "intense", the hill is surrounding by tall grasses that produce a calming sound. The second one is the Footbridge, a structure that crosses the eco-forest providing a beautiful sky view of it. Finally, and probably the most important part of this park is the Eco-forest itself. This forest full of wildlife such as rabbits, squirrels, birds of all kind, but the main feature here are the two species of deer. The eco-forest has an animal food vending machine on the entrance so visitor can purchase some food and enjoy of the experience of feeding the deer.

Experiential Learning Park: This park is located around the water purification plan and its goal is to promote environmental experiences for everyone. To achieve its goal, the park counts with an insect garden, Butterfly house, gallery garden and a small animals house, all of them free to accessed. The insect garden is composed of two levels and features different enclosed environments full of insects. It also counts with some reptiles, fish and small mammals' aquarium and at the end there is a room showcasing different families of dissected insects. The

butterfly house is a greenhouse full of flowers, plants and a small waterfall and pond. The greenhouse is full of different species of butterflies flying around and the smell of the flowers makes you forget that you are in the middle of a huge city. The gallery garden features several plants and flower sculptures of significant parts of the Seoul forest, such as the deer. The vast majority of the pants and flowers have tags identifying their species. The small animal house is an enclose rabbit playground, were both kids and parents can go to feed and even pet them.

Figure 18. Seoul Forest - Experiential Learning Park. June 28th 2016.

Figure 19. Seoul Forest - Wetland Eco Park. June 28th 2016.

Wetland Ecological Park: This park is located on the northern part of the Seoul forest and connects with the other parts by a small path through the trees. This park has 2 goals, to show nature in its true state and to introduce kids to environmental field trips and outdoor playgrounds. The park achieves the first goal by providing a bird observatory, from where one can observe the birds coming into the wetland., and by the marsh plant garden, a series of wooden bridges that cross the wetland that allow the observation of aquatic insects, fish and aquatic plants. To achieve the second goal, the park counts with and ecological learning center, which is full of several species specimens from the wetland, and most

interestedly by providing and open air nature awareness school. This open-air school is full of actives such as walking on a rope between trees or a water extraction and river circuit.

Ttukseom Hangang Park: this park was a popular place even before the Hangang river restoration. This park counts with one of the three decks from where to can take the Hangang river tour boat. It also has a natural riverside area where fishing g is allowed. On top of that the park houses several areas where all kind of water sports (such as windsurfing and waterskiing) are allowed, being one of the favorite hangouts for the energetic people of the city.

4.3.6 Iris Park

This park is in the northern part of the city. The park was opened to the public in June 7th 2009. This park main attraction are the irises located in it. The park is home of more than 130 different species of iris that cover the whole park during the months of May and June. However, these flowers are not the only attraction of the park. The park is divided into 12 different themes, and each has its own flowers and plants. One of the major attractions in the park is the pond, which is cover in aquatic plants almost completely, however in the areas that are not hundreds of koi fish can be seen. The pond has wooden bridges that allow walking over the pond to admire the scenery or to even feed the fish. Another major attraction of the park is the medicinal botanic garden, which shows most of all the medicinal plants that are used in the present in Korea. However, the most utilized and liked section by the residents of the area is the forest picnic area.

Figure 20. Iris park. July 3rd 2016.

This area has hundreds of pine trees with picnic tables in between providing an amazing shading area for eating and gathering.

4.3.7 Seoseoul Park

This park is located in the Southwestern part of the city, where the Gimpo Water Purification Plant used to be. The plant which first opened in 1959 was constructed for to supply more than 120,000 tons of tap water every day. At first the plant was operated by a private company, but in 1979 the Seoul Metropolitan Government took charge of it. The plant stopped its operation in October 2003 because of the "Seoul's Renewal Plan for Water Purification Plant". After the closure of the plant several different projects were consider for the area, but finally in 2006 the city decided to convert the plant into a public park because the lack of public natural places in the southwestern part of the city. The city also decided to restored the natural ecosystem and the trails of the Neunggolsan Mountain, which was adjacent to the plant to create a bigger park. The result of these restorations was the Seoseoul park, which opened in October 2009. The park was developed with the idea of water in mind, and therefore a lot of the parts of the park either include water on them. The focal point of the park is the water pond. In the center of the pond there are several "sound fountains" which eject cold water in the air automatically whenever the sense the sound of an airplane. This fountain was designed to celebrate that the Gimpo International airport is located nearby and that the park its under one of its landing/departing air routes. Another of the water theme features is the Mondrian garden. This garden is the result of the harmonization of horizontal and vertical lines and it was built using the waters purification plant settling tanks. The garden cycles rain water and it is composed of an aquatic plant gardens, a sky garden, and ecological stream and the most interesting feature, the

media wall fountain. This fountain uses the water falling in the wall as a screen in where videos and films are showcase with the use of LED lights.

Figure 21. Seoseoul Park. June 3rd 2016.

The northern part of the park was design as a place where the residents of the area could come to enjoy a whole day. It is in this area where the event table, the water playground, the recycled garden and the hiking trails are located. The event table is composed of 3 separated sections and it provides sitting for up to 100 people, making it the perfect place for community events, family picnics and any other celebration. The water playground is composed by a variety of metallic structures that spray water when people are next or in them. The recycled garden uses the water pipes of the water purification plant as pots to grow several plants, and it includes a community garden where a lot of vegetables are grown. Finally, the hiking trails are a set of paths that go around the mountain, and that ultimately lead the its top where a multipurpose ground with several exercising machines can be found.

4.3.8 Dream Forest

This park is in the northcentral part of the city. The park is located between to mountains in an area known as Dreamland. This area was known for been having just a couple of playground since 1989 that attracted people from the all the nearby districts. The park was developed after the city recognized, because of residents' complaints about having most of all

the major parks located south from the Namsan mountain, and that there was a necessity for a big natural area in the northern districts. The park was created with the purposed of providing a location where all the residents of this under could enjoy of a day in nature and therefore increase their happiness. To achieve this goal the city demolished the outdated playgrounds and decided to build a multi experience place that would satisfy kids, adults and elders necessity. After years of careful planning the park opened its doors in October 17th 2009.

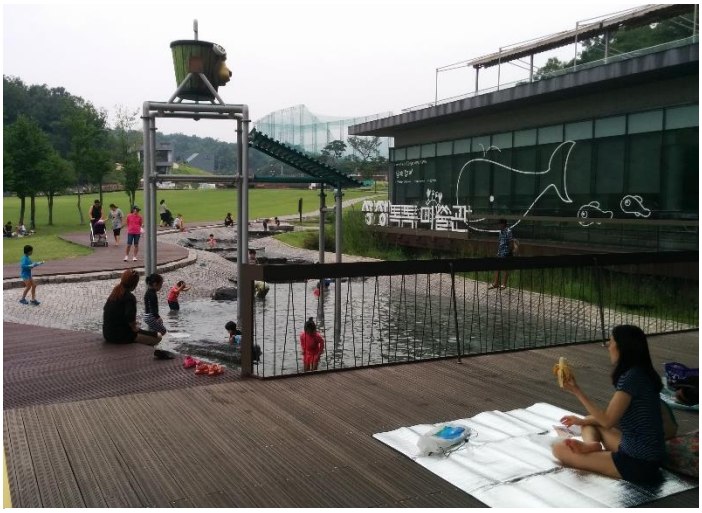

Figure 22. Dream Forest. July 3rd 2016

The park connects on the east and the west with to mountains that have miles and miles of trails, observatory decks and exercising machines. These mountains provide the park with a severe isolation from the surrounding urban environments, providing the sensation of a natural environment away from the city. The park is composed of 8 different sections. The visitor center, located on the southern part of the park, houses the story of the Dream forest park, and exhibition that explains the construction of the park, etc. The center also provides several education courses for kids and adults all year long. Located just west from the visitor center is the "Seven waterfall pond", a combination of 7 interconnected ponds with the goal of showcasing the power of hydroponics. Located north of the visitor center is the history garden. This garden seeks to recreate from the life of ancient Koreans, and it consists of structures featuring traditional architecture such as the Changnyeongwigung Ritual House, a bamboo forest, and the Wolgwangdae Pavilion. The history garden connects on the north with a pond. This pond is the

exact center of the park, and it provides visitors with the opportunity to enjoy of a fresh atmosphere in hot days. The pond has a pavilion on the side from where one can enjoy the view of the park and the relaxing sound of a waterfall. On the northern part of the park are the cultural and lawn plazas. These plazas provide water entertainment for everyone thanks to their jumping fountain, children's waterpark, and a mirror pond. On the edge of the cultural plaza is where the dream studio and the arts center are located, providing the neighborhood with a wide variety of cultural events, hence its name. Finally, on the east side of the park, the park features a botanic garden and deer garden. The deer garden was built with the donation of deer from the Seoul Forest to provide children with emotional cultivation.

4.3.9 Pureum Arboretum

This park is in the southwestern part of the city. Its name translates to Blue arboretum. The development of the park started in 2009 as a part of the Korea's Forest service "One Forest per City" campaign. During its development, the project became port of the city's "Making Seoul Greener" campaign and as consequence the park was restructure to include a four season garden, a forest learning center where classes could be hosted year round, and to act as a community center where citizens connect with nature. The was opened in June 6th 2013, just in time to the rose garden at its peak blooming.

Figure 23. Pureum Arboretum. June 3rd 2016.

The park is composed of 25 themed gardens, each representing a different Korean or foreign ecosystem. The two biggest gardens are the water garden, which is located on the southern part of the park's main pond, and the rose garden, located on the northern part

of the park. The park also features an edible garden, a vegetable garden and a gardening area where residents can volunteer and in exchange the learn how they can grow their own food.

4.3.10 Seoul Station 7017

The Seoul station 7017 is an undergoing project that is taking place in the elevated highway that crosses the Seoul Station. This highway was built in 1970, and was in used until 2006 when after the annual inspection of the highway the city decided to close it due to safety reasons. Several ideas came about what to do with the overpass, being demolition one of them. However, in order to decide what to do, the city created a citizen's committee and launched and international design competition. The winner of the competition, chosen by the committee, was the creation of a highland park that would connect the Seoul Station with several touristic places located just west from it. The construction of the project started in March 2016 and it is supposed to be finished and opened to the public no later than April 2017. This project will feature 17 different paths, include 684 tree pots, 21 amenities, and it is hope to act as the lungs for the middle part of city.

4.3.11 Inventory analysis

The constructed nature projects presented in this section are great examples of how developed and abandoned areas can be transformed into natural areas. They are also proof that when desired even the most remote and contaminated areas can be returned as biodiverse and enjoyable natural spaces to citizens. Moreover, since most landfills and waste treatment plants are located in impoverished neighborhoods, by transforming them, the city of Seoul has been able to increase accessibility to nature for low income families while increasing the access to total areas covered by vegetation.

Even though all these projects were designed and implemented independently, they all share something in common: their creation was the direct or indirect result of citizen

participation in government(e.g. Seoul forest was open thank you to tree planting hosted by residents; the dream forest park was built because of the several complaints the government received). Some of these projects would have never been started or reached completion without citizen intervention. Another common theme that can be appreciated across these projects is that even though the initial projects took place in nearby locations, the Seoul Metropolitan Government has tried to make nature accessible everywhere in the city by creating major parks in areas that did not have access to natural spaces for a long time.

5. DISCUSSION

The focus of this study was to evaluate how biophilic the city of Seoul was by using at least one indicator in each of the four biophilic cities dimensions identified by the Biophilic Cities Network. These indicators were measured using each of three analyses explained in the previous chapter. This discussion will interpret the results presented in the previous chapter to determine how the City of Seoul is performing in each of the four dimensions.

5.1 Natural conditions, qualities, and infrastructure

This study look at the three different indicators in this dimension: 1) Percentage of natural space coverage; 2) Percent of city population living within 300m of natural areas; 3) Number of new major projects of constructed nature, started or completed since 1996.

The percentage of natural spaces coverage in Seoul was quite high (37.38%), and so was the percentage of population living within 300m of natural spaces (94.39%). However, through the spatial analysis it was possible to appreciate that the access to nature as well as the percentage of coverage was not equally distributed throughout the city. Only 68.44% of Gangdong-gu resident lived within 300m of natural spaces, and people residing in Dongdaemun-gu and Yangcheon-gu hade less square footage of natural spaces per capita than the one recommended by the World Health Organization (9 m^2/person). This problem brings us to the third indicator, the number of major constructed nature projects started or finished since 1996. From the ten major projects, explored in the constructed nature inventory, three have taken place in the underserved districts, the Cheonggyecheon stream restoration starts in Dongdaemun-gu, the Seoseoul park is in Yangcheon-gu, and the Gildong ecological park is part of Gangdong-gu.

Furthermore, the percentage of population living within 300m of natural spaces (94,39%) is almost identical to the percentage of people living within 300m of green areas in the City of Oslo, Norway (94,3%) (Luccarelli & Roe., 2012), which is considered to be a very biophilic city (Beatley, 2016). Seoul park coverage can also be considered quite impressive when comparing it to U.S. cities. According with the Trust for Public Land (2015), there are only 4 cities in the U.S. with a higher percentage of residents living close to parks, New York, Washington, D.C., Boston and San Francisco, however, half a mile distance from parks was used for such analysis.

Finally, while not treated as an indicator, Seoul green space square footage per capita (22,97 m^2/person) is quite close to the green square footage per capita of the city of Vitoria-Gazteiz, Spain (25 m^2/person), the 2012 European Green Capital and partner city of the Biophilic Cities Network (Beatley, 2016). Therefore, it can be inferred that overall, the city of Seoul is abundant in natural infrastructure, and that the city government has tried to make nature available to all the residents throughout the city.

5.2 Biophilic engagement, participation, activities, and knowledge

This study look at the three different indicators in this dimension: 1) Percent of population visiting parks or green spaces daily; 2) Extent of membership in nature and outdoor-oriented clubs and activities;

The percentage of population visiting parks daily was quite low (16%), however, almost three quarters of the population said to visit parks or green spaces at least once a week. This shows the extent to which natural spaces are part of Seoulites weekly routines and might be the reason why there is a big amount of biophilic infrastructure. In addition, more than half of the population (56%) claimed they were part of a nature or outdoor-oriented group. This percentage was higher than expected for an urbanize area, and might be the most significant measure of

biophilic engagement, because people that said they were part of these groups scored significantly higher in the Connectedness to Nature Scale, which translates to a higher eco-friendly behavior. Moreover, as learned through the results of the constructed nature inventory, residents and environmental groups have a history of strong political power concerning nature restoration or introduction in the city. Consequently, it can be said that the extent of membership in nature and outdoor-oriented clubs and activities, it is a good indication of the biophilic engagement in the City of Seoul. However, it must be noted that there was not prior literature found that confirms of disconfirms this assumption.

4.3 Biophilic institutions, planning, and governance

This study looked indirectly at two different indicators in this dimension: 1) Existence of a biophilic cities strategy, action plan, or the equivalent and annual progress towards its goals; 2) Revisions to, and innovation in, development planning, policy, regulations, guidelines, and public engagement and education to incorporate and create biophilic values and goals through city planning, design, and development practice.

These two indicators were revised through the literature review and the major constructed nature projects inventory. While the city does not have a specific biophilic action plan, it does have an Agenda 21 and the 5-year parks and open space plans, which both target some of the biophilic city's values. On top of that, the city has done several changes in their planning policies to include biophilic values and goals. For example, it gave control of the operations of the Seoul Forest to the Seoul Green Trust organization. The Seoul Metropolitan Government create the Green Seoul Bureau, which oversees all the nature-related departments (e.g. park development division). Furthermore, the city announced the 2013 Green City Declaration, where the city compromise on extending its green spaces outside of park boundaries to become a "park city",

and it recognized the necessity of being a safe and environmentally friendly city as one of the five thematic areas in the 2030 comprehensive plan. The City of Seoul has also taken on several campaigns to make the city greener while engaging and educating the public with events such as the 'Plant 10 Million Trees", which aimed to turn the grey areas of the city into green full of life locations, the "Greener 1 Million Pyeong", a program which focused on creating public-private partnerships to increase the access to green areas for the public, and "The Citizen Gardener" and "Adopt-a-Tree/Park" programs (Kim, 2017).

Therefore, it can be said that the City of Seoul has governance and planning system that prioritizes the goals and values of biophilic cities.

4.4 Human health/Well-being

This study utilized two different indicators in this dimension: 1) Percent of population spending at least 30 minutes of the day outside; 2) Percent of population participating in 30 minutes of physical activity outside per day.

Almost everyone in the city of Seoul (89%) said they spent at least 30 minutes of their day outside, and a little over half of Seoulites (59%) said they engage in some sort of physical activity outdoors. The term outdoors and physical activity were not explained during the data collection because it has been widely proven that visiting nature (and therefore being outdoors) foe intervals of 30 minutes at least once a week has a significant effect in reducing depression and lowering high blood pressure (Shanahan et al., 2016), and because even the simplest form of physical activity, walking, has great amount of physiological and mental benefits when done outdoors and/or in nature (Barton et al., 2009; Johansson et al., 2011; Roe & Aspinall, 2011). Therefore, because pretty much everyone in the city walking at least 30 minutes every day, and

visits parks at least once a week (74%), the overall human health and well-being of Seoulites might be quite high.

It should be noted that the high number of people spending time outdoors might be the result of commuting to work using the different forms of public transportation available in the city, while, the percentage of people participating in physical activities outdoors might be the result of having natural spaces which tend to have trails, within 300m of Seoulites homes.

6. CONCLUSION

Despite not being equally distributed, the City of Seoul is abundant in natural infrastructure with 94,39% of residents living with 300m of natural areas. This parks are part of Seoulites weekly routines and most of the bigger ones have been developed because of citizen participation in government. Also, mon of Seoulites (90%) spend at least 30 minutes of their day outdoors. This high number of people be the result of commuting to work using the different forms of public transportation available in the city, while, the percentage of people participating in physical activities outdoors might be the result of having natural spaces which tend to have trails, within 300m of their homes.

The results and discussion presented in this research show the different ways that the City of Seoul performs on the biophilic indicators studied. After looking at each of the four biophilic cities dimensions, it can confidently be said that the City of Seoul is fairly biophilic as it perform in a great manner in three out of the four dimensions. This makes Seoul a suitable example to follow by other cities, specifically by those with similar cultural traits or geographical similarities, (e.g. China, Japan). Furthermore, this study shows that it is possible to include nature in the design of a megacity, and in the daily lives of its residents. This study also provides with some examples of how the inclusion of nature might take place in a non-western city through the case studies and literature review.

Future research should consider repeating the survey analysis, by gathering a bigger sample with surveys collected at every single district of Seoul. An in-depth study of the Seoul Metropolitan Government codes and ordinances would be recommended for a better understanding of the current political context. Additionally, future research could benefit from conducting interviews with some stakeholder such as the Seoul Green Trust.

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APPENDIX I: SURVEY

Inclusion of Nature in Urban Lives

Objective: to get information about the relationship between human and nature in the city of Seoul. All answers will be kept STRICTLY ANONYMOUS.

Part 1: Interaction with Nature

Please answer each of these questions by selecting the option that describe you the best. There are no right or wrong answers.

1. How much time of your day do you spend outdoors?
- Less than 30 minutes
- 30 minutes – 1 hour
- 1 - 2 hours
- 2 – 3 hours
- More than 3 hours

2. How much time do you spend outdoors doing some kind of physical activity?
- Less than 15 minutes
- 15 – 30 minutes
- 30 – 45 minutes
- 45 minutes – 1 hour
- More than 1 hour

3. Are you part of any nature or outdoor-oriented group? (E.g. Bird watching, gardening club, neighborhood nature clubs, etc.)
- Yes
- No
- N/A

4. How often do you visit public parks or green spaces? (E.g. local area?)
- Everyday
- Every other day
- Twice a week
- Once a week
- Every other week
- Once a month
- Less than once a month

5. Do you actively garden/grow any kind of food? (E.g. community garden, balcony gardens, etc.)
- Yes
- No
- N/A

6. What year were you born in?
- _____

7. How do you identify yourself?
- Male
- Female
- Other

Part 2: Connectedness to Nature Scale

Please answer each of these questions in terms of the way you generally feel. There are no right or wrong answers. Using the following scale, in the space provided next to each question simply state as honestly and candidly as you can what you are presently experiencing.

1	2	3	4	5
Strongly disagree		Neutral		Strongly agree

____1. I often feel a sense of oneness with the natural world around me.

____2. I think of the natural world as a community to which I belong.

____3. I recognize and appreciate the intelligence of other living organisms.

____4. I often feel disconnected from nature.

____5. When I think of my life, I imagine myself to be part of a larger cyclical process of living.

____6. I often feel a kinship with animals and plants.

____7. I feel as though I belong to the Earth as equally as it belongs to me.

____8. I have a deep understanding of how my actions affect the natural world.

____9. I often feel part of the web of life.

____10. I feel that all inhabitants of Earth, human, and nonhuman, share a common 'life force'.

____11. Like a tree can be part of a forest, I feel embedded within the broader natural world.

____12. When I think of my place on Earth, I consider myself to be a top member of a hierarchy that exists in nature.

____13. I often feel like I am only a small part of the natural world around me, and that I am no more important than the grass on the ground or the birds in the trees.

____14. My personal welfare is independent of the welfare of the natural world

APPENDIX II: SURVEY (KOREAN VERSION)

서울도심에서인간과자연의관계

목적: 본설문은서울도심에서인간과자연의관계에정보를수집하기위해작성되었습니다.
제공하여주신모든정보는익명으로처리됩니다.

Part 1:자연과의상호작용

다음 각 질문을 읽고 귀하에게 해당하는 항목을 선택하여 답변해 주십시오.잘못된 답변은 없습니다.

1. 선생님께서는얼마나많은시간을야외에서보내십니까?

- 30분미만
- 30분~1시간
- 1시간~2시간
- 2시간~3시간
- 3시간이상

2. 선생님께서는하루중얼마나많은시간을야외에서 보내십니까? (운동, 조깅)

- 15분미만
- 15-30 분
- 30-45분
- 45분-1시간
- 1시간이상

3. 선생님께서는본인이자연의일부에속해있다고생각하거나야외활동을선호하는편이십니까? (예: 새관찰, 정원가꾸기동호회등등)

- 그렇다
- 아니다
- 해당없음

4. 얼마나 자주 가까운 공원을 방문하십니까? (예:근린공원?)

- 매일
- 하루걸러
- 일주일에두번
- 일주일에한번

- 격주
- 한달에한번
- 한달에한번미만

5. 선생님께서는정원이나 텃밭을 가꾸는것을 좋아하십니까? (예:주말 농장, 주민 정원,베란다 정원 등…)

- 그렇다
- 아니다
- 해당없음

6. 출생 년도를 기록하여 주십시오.

- _____

7. 성별을기록하여주십시오.

- 남성
- 여성
- 그외

Part 2: 자연과의친밀도

선생님께서일반적으로느끼는기준에따라각질문에답변해주십시오.정답은없습니다.본인의경험을 바탕으로각질문앞빈칸에 1에서 5까지의척도중하나를골라,솔직하게숫자를기입해주십시오.

1 2 3 4 5

매우 그렇지 않다 중간
매우 그렇다

____1. 나는 종종 주변 자연환경과 일체감을 느낀다.

____2. 나는 나와 자연이 같은 공동체에 속해있다고 생각한다.

____3. 나는 인간이 아닌 다른 생명체도 지능을 가졌다고 생각한다.

____4. 나는 종종 자연과 단절되어 있다고 느낀다.

____5. 나는 나 자신의 삶이 자연의 순환 과정 중 일부분이라 생각한다.

____6. 나는종종동물과식물에게친밀감을느낀다.

____7. 나는내가지구의일부인것처럼지구역시나의일부가된다고생각한다.

____8. 나는 나의 행동이 자연환경에 어떤 영향을 미치는지 잘 알고 행동한다.

____9. 나는생명계의일부라고자주느낀다

____10. 나는 지구에 살고 있는 모든것 생명력을 공유하고 있다고 생각한다.

____11. 나무가 숲의 일부인 것처럼,나 역시 더 넓은 자연계에 속해있다고 생각한다.

____12. 나는인간이 자연에 존재하는 것들 중 최고라고 생각한다.

____13. 나는 종종 내가 자연의 아주 작은 일부일 뿐이고,나무 위의 새나 땅 위의 잔디보다 더 작은 존재라고 생각한다.

____14. 내개인적인행복은자연계안녕과관계없다.

APPENDIX III: SURVEY'S CONSENT FORM

Study Title

- Inclusion of Nature in Urban Lives.

Study Purpose and Rationale

- To get information about the relationship between humans and nature in the city of Seoul.

Inclusion/Exclusion Criteria

- You must have been born on today's date in 1998 or sooner.
- You must work and/or reside (permanently or temporally) in the Seoul metro area.

Participation Procedures and Duration

- This study is asking from participants to fill out the survey and return it. Please print all answers and follow the directions listed in each of the two parts of the survey.

Data Confidentiality or Anonymity

- All data collected from participants is completely anonymous and will only be used in the context of summarizing findings for the entire study in which no individual's answers can be identified.

Storage of Data and Data Retention Period

- The original data will be collected by participants filling the hard copies of the survey at the event. These will then be collected and only viewed by myself Unai Miguel Andres. Surveys will be kept in a locking security bag during the data collection period. After the return of Principal Investigator (Unai Miguel Andres) to the United States of America in August 2016 the data will be compiled into a spreadsheet. Digital files will be storage on a password protected USB and the original paper surveys will be destroyed. Only myself (Unai Miguel Andres) and Dr. Joshua Gruver will have access to the USB. The digital files will be kept for indefinitely.

Risks or Discomforts

- There are no perceived risks for participating in this study.

Benefits

- There are no perceived benefits for participating in this study.

Voluntary Participation

- Your participation in this research is completely voluntary and you can end your participation by not completing the survey. You may also decline to answer specific questions included in this survey. Please feel free to ask any questions of the investigator before or any time during the study.

IRB Contact Information

- For questions about your rights as a research subject, please contact the Director, Office of Research Integrity, Ball State University, Muncie, IN 47306, (765) 285-5070 or at irb@bsu.edu.

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APPENDIX IV: SURVEY'S CONSENT FORM (KOREAN VERSION)

연구제목

- 도시생활속의 자연 존재

연구목적

- 서울 도심에서 인간과 자연의 관계에 대한 정보를 얻을 수 있습니다.

포함/제외 기준

- 1988년도 이후에 출생한 자
- 서울시에 거주하는 자 또는 일을 하는 자 (영구적 또는 임시적)

참여 절차 및 기간

- 본 연구는 참여자로부터 설문조사를 작성하고 본 연구는 설문 조사를 작성하고 반환하는 참가자 요구하고있다. 모든 대답을 인쇄하고 조사의 두 부분으로 각각에 나와있는 지시 사항을 따르십시오.

데이터 기밀성 또는 익명

- 참가자로부터 수집 된 모든 자료는 익명으로 수집되며 전체 연구 결과를 식별하기 위해서 사용된다.

자료보관 기간

- 원본 자료는 설문지 복사본을 작성한 참가자에 의해 수집됩니다. 이 후, 설문지는 우나이 미겔 안드레스에 의해 검증됩니다. 설문지는 보안가방에 보관되며 조사관 (우나이 미겔 안드레스)이 2016년 8월 미국으로 돌아간 후 자료는 스프레드 시트로 편집됩니다. 디지털 파일은 암호로 보호 된 USB에 저장되며 원래의 설문종이는 파괴됩니다. 우나이 미겔 안드레스와 죠수아 교수만 USB에 접근 할 수 있습니다. 디지털 파일은 무기한 보관됩니다.

위험요인

- 본 연구 참여에 대한 불이익은 없습니다.

혜택

- 본 연구 참여에 대한 혜택은 없습니다.

자원참가

- 본 연구 참여는 자발적이며 당신은 설문 조사를 완료하지 않음으로써 참여를 종료 할 수 있습니다. 또한 본 조사에 포함 된 특정 질문에 대한 답변을 거부 할 수 있습니다. 연구 기간 동안 질문이 있으시면 언제든지 문의 주시기 바랍니다.

IRB 연락처

- 연구 주제로 귀하의 권리에 대한 질문은 아래의 연락처로 연락바랍니다. 볼주립대학교 연구원 연락처: (765) 285-5070 or at irb@bsu.edu.

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APPENDIX V: STEP BY STEP SPATIAL ANALYSIS GUIDE

The first step, prior to any analysis and after extracting the Seoul biotope shapefile, was translating the fields of interest (land use, districts, and area) from Korean to English. This translation was done with help of the Seoul Solution's social maps of Seoul (2016), a set of maps created with biotope mapping data that show different social characteristics of the city of Seoul with a legend both in Korean and English. The translated data was entered in new fields named "District", "Land_Use", and "Area".

Calculating the percent of natural areas coverage within the City of Seoul

1. The natural areas layer was created by using the "Select by Attribute" feature with the formula "District" = 'Green & Open Space' OR "District" = 'Rivers & Lakes' in the biotope layer. Once the desired data was selected, it was extracted using the "Select" tool (Analysis Tools > Extract > Select).
2. The districts layer was created by using the "Dissolve" tool (Data Management Tools > Generalization > Dissolve) in the biotope layer. The field used to conduct the dissolve was "District", the "SUM" (total value) of the "Area" field was chosen to be calculated, and the "create multipart features" option was checked.
3. The same process as the one in step 2 was also used to create the natural areas by district layer using the "Dissolve" tool in the natural areas layer.
4. The "Join" feature was used to combine the data of district layer with the data of the natural spaces by district layer, choosing the "District" field as the one the join was based on. After the join was performed and the duplicated data was hidden, the data was exported using the "Export Data" feature, to create a new district layer (called District2).

5. Three new fields were created in the district2 layers. The first one, called “Pop” was populate with the population data from the 2015 Koran census. The second one, called “Nature_pct”, was populated using the formula [Natural_Area] / [Total_Area] in the field calculator. The numbers in the “Nature_pct” field show the percentage of area per district cover by natural sareas The third field, called “Nat_cap” was populated using the formula [Natural_Area] / [Pop] in the field calculator. The numbers in the “Nat_cap” field show the natural area available per capita.
6. The table of the District2 layer was exported to excel using the “Table to Excel” tool (Conversion Tools > Excel > Table to Excel). The exported data was used to calculate the percentage of natural areas coverage for City of Seoul as well as the overall natural area per capita in the city.

Calculating the percent of the city’s population living within 300m of natural areas

1. The residences layer was created by using the “Select by Attribute” feature with the formula “District” = ‘Mixed Residential/Commercial” OR “District” = ‘Residential’ in the biotope layer. Once the desired data was selected, it was extracted using the “Select” tool (Analysis Tools > Extract > Select).
2. The residences by district layer was created by using the “Dissolve” tool (Data Management Tools > Generalization > Dissolve) in the residence layer. The field used to conduct the dissolve was “District”, the “SUM” (total value) of the “Area” field was chosen to be calculated, and the “create multipart features” option was checked.
3. The residences within 300m of natural areas were using the “Select by Location” feature. The target layer was the residence layer, the source layer was the natural area

layer (created in the other analysis), and the spatial selection method was “are within a distance of the source layer feature” using a distance of 300 meters.

4. The selected features were extracted using the “Select” tool to create the residences within 300m layer.
5. The “Dissolve” tool was used in the residences within 300m layer, with the same parameters as in step 2, to create the residences within 300m by district.
6. The “Join” feature was used to combine the data of district2 layer (created in the other analysis), with the data of the residences by district layer and the data from the residences within 300m by district. The “District” field was chosen as the one the join was based on. After the join was performed and the duplicated data was hidden, the data was exported using the “Export Data” feature, to create a new district layer (called District3).
7. Two new fields were created in the district3 layers. The first one, called “pop_pct’ was populated using the formula [Residences_Within] / [Total_Residences] in the field calculator. The numbers in the “pop_pct” field show the percentage of residences per districts that area within 300m of natural areas. The second field, called “Pop_withou” was populated using the formula [Pop] * (1 - [pop_pct] in the field calculator. The numbers in the “Pop_withou” field show the number of people without access to natural areas within 300m of their residences.
8. The table of the District3 layer was exported to excel using the “Table to Excel” tool (Conversion Tools > Excel > Table to Excel). The exported data was used to calculate the percentage of residences in the City of Seoul that are within 300m or natural

areas, as well as the number of residents in the city without access to natural areas within 300m of their residences.

APPENDIX VI: MAP OF SEOUL'S DISTRICTS

APPENDIX VII: MAP OF SEOUL'S POPULATION BY DISTRICTS